Concrete

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Kolinski Ready-Mixed Concrete Plant Equipped to Save Labor

Efficiently Arranged Plant Reduces Operating Force to One Man—Produces 600 Cubic Yards in Day—Concrete of Guaranteed Strength—Heating System for Winter

A READY-MIXED concrete plant in which the plant arrangement and the proportioning and mixing equipment approach closely to the ideal, is that of the Kolinski Ready-Mixed Concrete Company, in Milwaukee.

The plant is located at 127 S. Eleventh street, close to the main business section of the city. It is served direct by a railway siding, and thus far all materials are received either by rail or by motor truck. In addition, the plant lies between two slips connecting with the Menominee Canal, so that materials for concrete could be received by water transportation if necessary or desirable.

Plant Arrangement Eliminates Labor

The entire plant arrangement, including the facilities for the receipt of cement and aggregates, and the arrangement and equipment of the mixing plant itself, is designed with the view of holding the number of plant operators down to the minimum.

The reduction in the number of plant operators is made possible, first, by the installation of labor-saving equipment and devices, and second, by arranging that equipment so that it may be controlled from one point. While the installation of complete equipment involves some additional capital outlay at the start, the advantages to be gained in reduced plant labor charges far outstrip the interest and depreciation charges against the equipment. As Mr. Kolinski pointed out to a representative of CONCRETE, the need for keeping the number of plant operators down to the minimum arises from the great fluctuation in the demand for the product. These fluctuations in demand occur from day to day. They can not always be anticipated; and even when they can be anticipated, nothing can be done about it except to supply the demand as it develops. A plant that has three or four operators, Mr. Kolinski explained, has too many men hanging around with little or nothing to do during the frequent periods of low demand. In the meantime their pay goes on just the same, as an additional charge to overhead expense; and it is, moreover, an uncertain element because the non-productive labor charges arising from this source are difficult to estimate in advance.

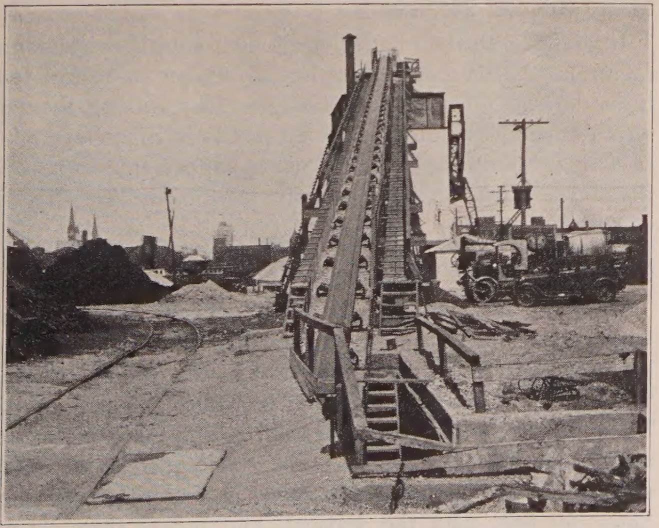

Figure 1. Track pit where all aggregate is received, whether shipped by rail or truck.

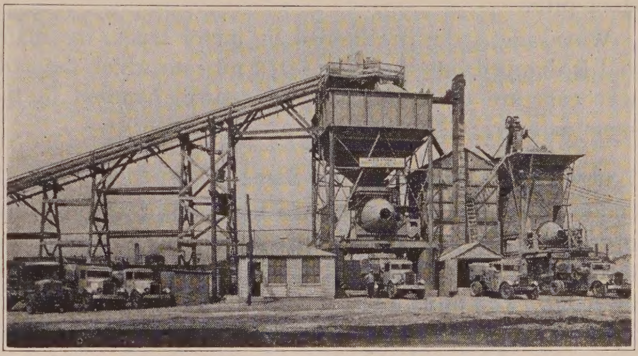

Figure 2. General view of Kolinski Ready-Mixed Concrete Co. plant, showing arrangement of storage bins and mixing plant before inclosure was built.

Kolinski Plant Operated by One Man

In the Kolinski plant the man who operates the yard crane that handles yard-stored aggregates also loads the overhead bins and drives a concrete delivery truck. The rest of the plant, including the weighing of aggregates and cement, the control of the mixing water, charging and discharging the 3-yard mixer, heating water in the winter season, and various other items that need attention, is operated by one man. This operator has on frequent occasions turned out as much as 600 cu. yd. of ready-mixed concrete in a 10-hour day.

Handling Sand and Gravel

Aside from a manufactured light-weight aggregate shipped from Indiana Harbor, Indiana, the plant uses sand shipped from Hartland, Wis., and gravel from local gravel pits. Some of the material is received by rail and some by truck. Material received by rail is shipped in battleship cars and is dumped into a track pit; or, when a number of cars are received at one time, they are shunted to the part of the spur siding beyond the track pit, where space is available for 18 cars. The cars are then pulled up to the track pit by the yard crane, one at a time, and unloaded.

From the track pit the material is conveyed a short distance by means of a plate feeder to the foot of the sloping belt conveyor that transports it to the aggregate bin above the mixing plant. When the bin hoppers are full, the plate feeder throws the material across the foot of the belt conveyor into a 6-yard pit, from which the yard crane, equipped with a clamshell, transfers the aggregate to stock-piles.

When aggregates are hauled by motor truck, the material is dumped into the same track pit into which the railway cars are unloaded, and, of course, handled in the same manner.

Large Aggregate in Three Sizes

The capacity of the aggregate bin totals 400 tons. The bin is divided into four compartments, one for sand and three for the three sizes of coarse material regularly kept on hand. The three sizes of coarse aggregate include the ⅜-inch pea size, another with ¾-inch as the maximum size, and a third with 2-inch maximum.

Thawing Out Conveyor in Winter

As the illustrations indicate, the long belt conveyor that transports aggregate from the track pit to the 400-ton overhead bin is unprotected from the weather. Occasionally, in the winter season, the belt becomes coated with ice. Three coke salamanders, set in the unloading pit just below the base of the conveyor, thaw out and dry the belt in 15 or 20 minutes.

Handling Cement

Cement is hauled in bulk by dump trucks from local storage silos, several of which are located in the immediate vicinity of the plant. The bulk cement is dumped in a protected hopper located just below ground level at the side of the plant. From this hopper the cement is carried vertically by an inclosed bucket elevator shown clearly at the side of the structure in the general views of the plant (Figures 2 and 3). From the top of the vertical bucket elevator the cement is carried horizontally to the mixing plant hopper.

The Mixing Plant

The mixing plant is a model of efficiency. The arrangement of the various features of the proportioning and mixing mechanism is such that all may be reached or seen from one small platform.

As the operator stands at the levers controlling the aggregate gates, he may glance to the left and read from a large chart the exact weights of the quantities of material required for a 3-yard batch of concrete of various proportions and crushing strengths. To his right, and within reach, is a large 36-inch Kron dial marked for weighing up to 13,000 lb., a little more than enough to measure the materials for 3 cu. yd. of concrete at one weighing.

Back of the operator, also within reach, are the controls that operate a Badger electric water meter which regulates the quantity of water by volume, but also checks the quantity by weight, within half a pound.

In weighing batches of cement, this plant utilizes a device developed by Hobart Brothers, in which air is used to fluff the cement prior to weighing it. The fluffing process eliminates lumpy packs and increases the accuracy of the weights recorded. The gate that shuts off the flow of cement is a valve gate type, of Fuller-Kinyon manufacture, that cuts off the flow instantly and prevents loss of cement due to dripping.

The aggregate gates consist of a series of clamshell gates, of Blaw-Knox manufacture, with a lever system arranged so as to concentrate the control of the gates at one point. This concentration of control levers is a detail that was devised especially for the Kolinski plant. As previously stated, this arrangement places the operator in a position from which all other operating mechanism may be reached.

The mixer itself is a 3-yard tilting Smith mixer equipped with a Hart weigh-mixer, supplied by the same manufacturer. A unique attachment to the weigh-mix equipment is a vibrating device that hastens the flow of the weighed batch into the mixer and prevents small quantities of material being retained in the weigh-batcher.

With the aggregate levers, the proportioning chart, the weighing dial, and the cement weighing and water control equipment all conveniently located, the one operator is able to weigh all materials for a 3-yard batch and to charge the mixer in less than one minute. Actual mixing of a batch is continued for two minutes.

Many Special Devices

In addition to the regular equipment supplied by manufacturers, the Kolinski plant has a number of useful features devised by the plant management. Among them is an air cushion chamber about 10 inches in diameter and 5 feet high, hooked up with the water supply line to absorb the shock when the flow of water at the mixing plant is cut off.

Heating System for Winter Season

Only the mixing water is heated during operations in winter, for the reason that the entire inclosure is kept warm enough to keep the moisture in the aggregate from freezing. The heat for the plant inclosure comes from the boiler in the boiler room adjacent to the main inclosure, and from the boiler stack. The stack, instead of being set in the usual vertical position, is set at an angle of about 40 deg. with the vertical, and passes through the main inclosure. Through this unique arrangement the radiation from the stack is utilized instead of wasted.

The statement that only the mixing water is heated must be modified in cases where the aggregate, when charged into the mixer, contains frozen lumps that have not been thawed out by the room temperature of the main inclosure. For this purpose a Heil oil burning torch has been installed so that it shoots a 7-ft. flame into the mixer. This burner spreads a flame throughout the entire mixer.

The mixing water is kept in a 565-gallon reserve tank connected with the boiler, and the temperature in the reserve tank is kept at 200 deg. F. This reserve tank also supplies the hot water for cleaning the trucks upon their return from a trip. The temperature of the water in the reserve tank is held at 200 deg. by a Heil oil burner installation that operates automatically, without the attention of an attendant. The fuel oil tank has a capacity of 1,000 gallons.

Truck Equipment

The Kolinski company owns eight trucks of 3 cu. yd. capacity. Three of the trucks are equipped with Blaw-Knox agitator bodies, two with Rex bodies, two are the bathtub type, and one is an experimental body undergoing a service test.

An interesting feature of the truck equipment is seen in the three Blaw-Knox bodies, which are mounted on Relay trucks and equipped with a Heil high-lift hoist installation. These trucks are found especially serviceable for delivering concrete into distributing hoppers placed at ground level or below, or into portable chutes.

Figure 4 shows one of these high-lift trucks in service, dumping the concrete into a distributing hopper of the type usually employed in buggy distribution. The bodies of these trucks are the open top agitator type, consisting essentially of a semi-circular steel shell, in which a longitudinal steel shaft is mounted. Paddle arms are attached to the shaft, and the shaft is turned by means of a series of gears, connected by a power take-off on the truck transmission. The agitator blades operate at a speed of three to four r.p.m. The agitator bodies just described can be used for hauling bulk material without necessitating removal of the agitating mechanism. The capacity for bulk material, when heaped, is 4¾ cu. yd.

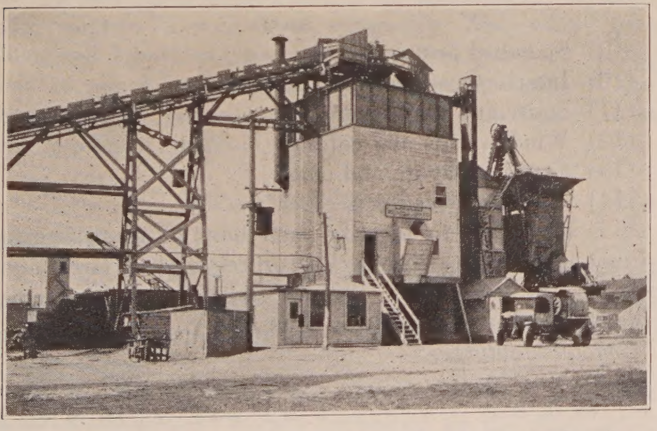

Figure 3. General view of plant after being inclosed.

Supply Distributing Hoppers to Trade

The Kolinski Ready-Mixed Concrete Company supplies its customers with 2-yard distributing hoppers, which may be placed at ground level and filled by a high-lift truck, as shown in Figure 4, or set in the basement excavation and filled by trucks of any type.

Prices to Contractors

Concrete is supplied, preferably, on a guaranteed strength basis; but some customers continue to order concrete on the old basis of arbitrary proportions, so that the company supplies its product on either basis.

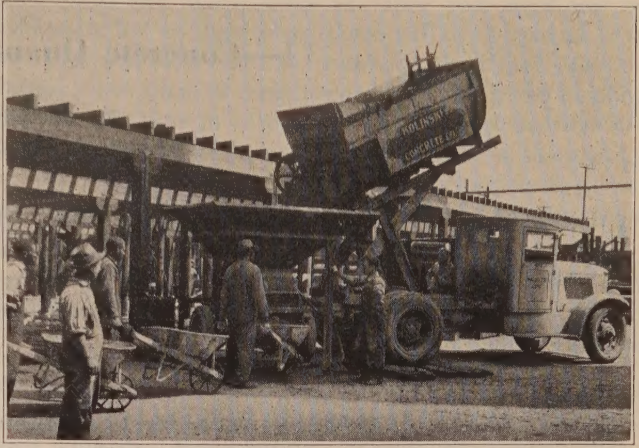

Figure 4. High-lift truck delivering concrete of guaranteed strength into distributing hopper supplied to customer.

Prices per cu. yd. to contractors, in locations anywhere in the city limits, are quoted on the guaranteed strength basis as shown in Table 1.

TABLE 1

Prices to Contractors on Guaranteed Strength Basis

Purpose	28-day crushing strength lb. per sq. in.	Slump 2 to 4 in.	Slump 4 to 6 in.	Slump 6 to 8 in.
Garage footings and walls	2,000	$7.00	$7.40	$7.80
Footings, floors, walls	3,000	7.50	7.90	8.30
City paving	3,300	7.75	8.00	8.40
Sidewalks, curbs, industrial driveways	4,000	8.25	8.75	9.25
24-hr. high-early-strength concrete	5,000	10.00	10.50	11.00

Prices per cu. yd. to contractors, in locations within the city limits, are quoted on the old arbitrary proportions basis, as indicated in Table 2.

TABLE 2

Prices to Contractors on Arbitrary Proportions Basis

Purpose	Proportions	Slump 2-4 in.	Slump 4-6 in.	Slump 6-8 in.
Walls, garage footings	1:3:5	$7.00	$7.00	$7.00
City paving	1:2:4	7.50	7.50	7.50
Garage floors, walls	1:3:3	7.50	7.50	7.50
Sidewalks (city)	1:2:3	8.00	8.00	8.00
Special strength (machine bases)	1:1½:2½	9.50	9.50	9.50
Facing	1:3	10.50	10.50	10.50
Facing	1:2	12.00	12.00	12.00

M. C. Kolinski is proprietor and manager of the plant described. Detailed drawings of the plant were prepared by the Boehck Machinery Company, of Milwaukee.

Estimating Cost of Concrete Work

Basis on Which Unit Prices Are Established—Taking Off the Quantity of Concrete Work—Summary of Labor and Material Costs

I—Concrete Quantities and Unit Prices

By LESLIE H. ALLEN
Aberthaw Company, Boston, Mass.

THERE is no perfect method or form for taking off quantities. Each job must be considered as a separate problem and treated accordingly. It is, however, important to lay down a systematic method of procedure and follow the same system on every job.

In order to estimate correctly the cost of reinforced concrete work the first essential is a correct take-off of the quantities of labor and material involved. It is probably true that nearly half the losses sustained by contractors are due to incorrect quantity estimates.

In measuring quantities it is important not only to get the total quantities correctly measured, but to distinguish and separately measure and describe each part of the work that is likely to differ in labor costs from other parts.

For instance, the labor on forms for floor slabs is usually about half the labor on forms for beams; column forms cost more than footing forms; and concrete in small isolated footings or piers cost a good deal more than concrete in floor slabs or pavings. These must all be measured and priced separately.—The Author.

Establishing Unit Prices

The estimated cost of any item of building work should be arrived at by multiplying the estimated number of labor hours that the work should take by the rate per hour paid in the locality; and adding thereto the local costs of the material required and the pro rata costs of plant tools and equipment.

In practice this is very rarely done. Very few contractors keep cost records in the form of labor hours worked, but every well-organized contracting firm does keep a record of the unit costs, in dollars and cents, of its work. When labor rates change the firm's estimator adds or deducts from these costs a percentage to bring his figures into line for estimating new work.

In this article, therefore, the common practice will be followed. The figures given are based on the following labor rates:

Carpenters, $1.50 per hour.
Laborers, $0.85 per hour.
Steel men, $1.50 per hour.
Hoisting engineman, $1.50 per hour.
Cement finishers, $1.50 per hour.

There is, however, no uniformity in contractors' costs even among those working in the same locality and paying the same wage scale. The figures given in this article are not the actual costs that the reader may expect to secure on his own work; they are given to indicate how the price should be estimated and what the cost ratio between different parts of his building should be. Using these as a guide, the estimator should make up his own figures, correcting the units given in accordance with his own experience and the cost units he is securing on his own work.

For concrete work it is usually best to start at the bottom and work upward, taking first all the concrete itself and following with the forms, reinforcement, the finish, and so on.

Take the concrete work on a typical building as follows:

(1) Footings.
(2) Foundation walls.
(3) Any other concrete work below grade.
(4) External columns—1st, 2nd, 3rd floor, etc.
(4a) Column brackets or heads, if any.
(5) Interior columns, basement, 1st, 2nd floor, etc.
(5a) Column brackets or heads, if any.
(6) Walls above grade, curtain walls, partitions, etc.
(7) Interior paving.
(8) Floor slabs.
(8a) Drop panels, if any.
(9) Spandrel beams.
(10) Interior beams and girders.
(11) Stairs and landings.
(12) Window sills and copings.
(13) Exterior paving and curbs.
(14) Miscellaneous items.

It is important to identify each item of measurement so that it can be easily checked or referred to later, and it is well to keep length, breadth and height in the same order throughout the job; for example:

Concrete footings:

Col. No. 1-6, inc.	5′9″ x 5′3″ x 2′0″ x No. 6
Col. No. 7, 8	4′2″ x 4′2″ x 1′10″ x No. 2
Col. No. 9	6′1″ x 6′3″ x 2′3″ x No. 1

Concrete exterior columns:

Col. No. 1-6, inc., 1st floor	2′8″ x 1′8″ x 11′0″ x No. 6
Col. No. 1-6, inc., 2nd floor	2′8″ x 1′6″ x 10′4″ x No. 6

In each of the foregoing cases the horizontal length comes first, then the width or thickness, then the height, and then the number of units, if more than one has the same measurement. In the left margin reference marks should be placed so that any measurement can be afterward identified. The small amount of extra labor thus spent is well worth while; as, if an item is accidentally omitted, it can be easily detected and the whole take-off can be quickly checked by others.

It is customary to measure all concrete work by the cubic foot or cubic yard, except stairs, window sills and similar items, in which the labor is out of all proportion to the yardage placed. Openings, except small ones, should be deducted; but space occupied by reinforcing bars, steel framing, pipes and conduits embedded in the concrete is not deducted.

Concrete in floor slabs should be measured for the entire area of the floor, and then the extra concrete in beams and girders below the slab added. Note that in designing concrete T-beams the full depth from the top of the slab to the underside of the beam is indicated on the drawings; after measuring the slab concrete it is only necessary to add the additional concrete below the ceiling. Thus if the drawing shows a four-inch slab with five beams 12 by 20 in., the measurements would read as follows:

Concrete slab	50′0″ x 18′0″ x 0′4″
Concrete beams	18′0″ x 1′0″ x 1′4″ x No. 5

In order to avoid excess measurement, at intersection of slabs, columns and beams, without wasting time in measuring very small items, the following rules will be found useful:

Measure floor slabs for the full area of the top surface.

Measure columns from the top of the lower slab to the ceiling of the slab above.

Measure girders the net length between columns.

Measure beams the net length between girders or columns, as the case may be.

This will result in a small shortage of concrete in exterior columns that project beyond the edge of the floor slab, and a slight excess of forms on beam and column intersections. This may safely be ignored.

In taking quantities for concrete floors of so-called "tin-pan" construction (metal pans being used to form slab soffits and sides of ribs), it is not necessary to measure concrete in each beam separately. This would be a long and laborious operation. It is best to take a typical bay or panel and compute the average thickness of concrete in slab and ribs and then apply this figure to the whole area of the floor.

CONCRETE COSTS

Labor Costs

The labor cost of a cubic yard of concrete includes the receiving and unloading of the materials, charging the mixer, hoisting the concrete, and placing and spading it in the forms.

Floating or troweling the surface, removing fins, rubbing surfaces, etc., cannot be priced by the cubic yard. These are considered separately, under "finishes."

Unloading and piling cement with 85-cent labor should cost about 5 cents per barrel. Unloading sand and gravel costs very little if it is dumped from a truck, as the only labor used will be in the trimming of the stock-piles, which the prudent contractor will accumulate as a reserve against contingency of a break-down in his trucking service.

Placing materials in the mixer and hoisting to the floor levels will cost about 70 cents per cubic yard. This cost should run uniformly through the job when at least half a day's steady concreting is done at a time. When only a few yards are placed during the day the costs will be somewhat higher, as men do not work efficiently when not working continuously.

In many large cities the use of ready-mixed concrete delivered in mixer trucks to the job is on the increase. In such cases the above items of labor cost need not be reckoned, but in their place there will be a cost of 5 to 10 cents per cubic yard for receiving the mixed concrete in the chute, plus 10 cents per cubic yard for the hoisting engineman's time in lifting it to the point of distribution.

The big variation in concrete labor comes in the placing of the mixed material in the forms. Nothing but long experience and good judgment can estimate correctly how these costs will vary from job to job.

It is obvious that the cost of concreting a floor slab 10 in. thick and having an area 100 by 100 ft. will be less per cubic yard than a floor slab 5 in. thick with an area of 200 by 100 ft. even though the total quantity is the same. In the latter case the average distance to be wheeled is greater and the amount of spading per cubic foot is nearly twice as much. Concrete in isolated beams, stairs or small piers can only be placed very slowly and will cost much more than thick slabs or large footings.

The following average costs are therefore only to be used as a guide:

	Per cu. yd.
Placing concrete in footings	$1.50
Placing concrete in floor slabs not more than 4½ in. thick	1.80
Placing concrete in floor slabs more than 5 in. thick	1.10
Placing concrete in columns and thin walls	2.00
Placing concrete in walls exceeding 15 in. in thickness	1.00

Cost of Materials for Concrete

Cement for any job requiring 1,000 bbl. or more should be bought in carload lots and delivered direct to the job. If there is a railroad spur track on the site it can be unloaded at the job. If not, the cost of unloading and trucking to the job must be added.

The local cement dealers will quote prices f.o.b. car or f.o.b. trucks at the job, as the case may require.

Assuming cement in paper bags (4 bags per bbl.) to cost $2.25 per bbl. and trucking 10 cents per bbl., the cost delivered will be $2.35 per bbl.

On large jobs it is more economical to buy cement in cloth sacks. This will add 25 cents per bbl. to the price in paper, but the cement companies will allow a credit of 10 cents per sack for those returned to the mill in good condition. If sacks are carefully looked after and returned the contractor can usually reckon on a loss of not more than 10 per cent of the sacks he receives. Allowing for this, plus the small expense for labor in bundling empty sacks and freight to the mill, he should save about 20 cents per bbl. on the cement purchases for the job.

Many architects also require the contractor to furnish tests from a recognized testing laboratory on each carload of cement. The usual charge is 3 cents per bbl. on the entire order.

Sand and gravel are usually purchased from local dealers who will quote a price per cubic yard or ton, delivered in trucks. Average city prices will run about $1.00 per ton for sand and $1.50 for gravel. Crushed stone costs a little more than gravel. For estimating purposes, reckon that 100 lb. of sand or gravel equal 1 cubic foot.

The following quantities should be figured for cement, sand and gravel per cubic yard of concrete:

	1:1:2 mix		1:1½:3 mix		1:2:5 mix		1:2½:5 mix	
Cement	3 bbl.		2 bbl.		1.5 bbl		1.25 bbl.	
	Cu.yd.	Tons	Cu. yd.	Tons	Cu. yd	Tons	Cu. yd.	Tons
Sand	0.5	0.65	0.5	0.65	0.5	0.65	0.5	0.65
Gravel	0.8	1.1	0.9	1.2	0.9	1.2	0.9	1.2

These quantities will give a slight surplus of aggregate which should be sufficient to cover waste on the job.

The new method of specifying concrete by ultimate strength, leaving it to the contractor to figure out (by testing local materials governed by scientific grading of aggregate and selection of cement-water ratio) the proportions required, usually gives more economical results. This method generally calls for more sand and less coarse aggregate than the old methods. The contractor will often find that to produce 2,500-lb. concrete 20 per cent more sand and 10 per cent less stone and 5 per cent less cement can be used than is called for in the usual 1:2:4 mix.

Summary of Cost Per Cubic Yard

Using the unit prices given above, the total cost of a cubic yard of 1:2:4 concrete may be summarized as follows:

Labor, unloading cement, 1.5 bbl. @ 5 cents		$0.08
Labor, mixing concrete		.60
Labor, placing concrete		1.80
Total labor		$2.48
Material, 1.5 bbl. cement in paper @	$2.35	
Tests	.03	
	$2.38	$3.57
0.65 tons sand @ $1.00		.65
1.2 tons stone @ $1.50		1.80
Total per cubic yard		$8.50

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(The next installment, in the July issue of CONCRETE, *will cover the estimating of labor and material on concrete form work.)*

Research Program Adopted by National Ready-Mixed Concrete Association

A program for research enabling the preparation of ready-mixed concrete specifications was one of the matters outlined at the meeting of the executive committee of the National Ready Mixed Concrete Association at the Congress Hotel, Chicago, on May 14 and 15. Another was the preparation of a uniform cost accounting method for ready-mixed concrete plants.

The second annual convention of the association, according to the executive committee, will be held on January 25 and 26, at the William Penn Hotel.

The program of research provides that individual producers of ready-mixed concrete co-operate by permitting the use of their plants in conducting the research activities.

It is expected that the investigations to be conducted by the association will supply information from which a suitable purchase specification may be developed.

Some of the problems which are to be subjected to thorough investigation, in the course of the research program, include a study of the effect of length of haul; the required period of agitation, whether necessary for the entire haul or for a stated period only; necessary length of time of mixing, especially where concrete is transported in agitator bodies; factors affecting uniformity of strength; and efficiency and accuracy of weighing and other plant equipment.

On the question of length of mixing time, some producers of ready-mixed concrete have expressed the opinion that periods of 1½ to 2 minutes will not be found necessary in cases where the concrete is transported in agitators. On the contrary, other producers take the position that 2-minute mixing is good advertising.

Members of the executive committee of the association who attended the meeting included J. E. Burke, president of the association and general manager of the Ready-Mixed Concrete Co., Pittsburgh, Pa.; Paul P. Bird, of the Boston Sand and Gravel Co., Boston, Mass.; H. F. Thomson, vice-president, General Material Co., St. Louis, Mo.; R. B. Young, consulting engineer, Toronto Ready-Mix Concrete Co., Toronto, Ontario; and Albert Shiely, of St. Paul, Minn., acting for J. L. Shiely, president of the J. L. Shiely Co., producers of ready-mixed concrete.

More About Raising Concrete Road Slabs with Mud Pumps

The raising of settled concrete highway slabs with a compressed air-driven mud pump was described in the January, 1931, issue of "Concrete."

Additional data on this interesting development will be published soon.

This matter is of exceptional interest to state and county highway departments who are confronted with settlements of road slabs on fills or marshy land.

How a Manufacturer of Cast Stone Built Up a Business

How a manufacturer of high grade cast stone built up a business in a city having a population of 60,000 is a story that will be told soon in "Concrete."

For special reasons this city offered a good potential market; but before the advent of this cast stone plant the business all went to natural cut stone.

The change from natural stone to cast stone did not come about without effort. How that effort was directed will constitute a considerable part of the story.

How Cast Stone Institute Research Will Develop Business

Committee Sees Research as Main Purpose of Institute — Some of Subjects Scheduled for Study — Data on Industry Gathered Through Personal Contact

By HERMAN FRAUENFELDER
Chairman, Research Committee, Cast Stone Institute

THE United States Chamber of Commerce has expressed the opinion that "among constructive activities of trade associations, none is more profitable than scientific research."

Experiences of other industries teach us that research is profitable. It has brought about the present efficient automobile, rustless or stainless steel, the present radio, and what interests us mostly, the continued improvement of portland cement. Just a casual reading of business and financial papers in the last few years tells us to watch our investments lest research and chemistry may over night substantially decrease their value.

Research the Principal Institute Activity

From the beginning of its organization, the Cast Stone Institute realized that research was to be one of its important activities. We fully realized the possibility of improving our product, good though it is. Subconsciously we knew that improvement depended upon scientific investigation and that upon the continued improvement of our product depended our success. We expect successful results. Our ultimate goal is a product that will bear the stamp, "It is a standard building material to be used without hesitation or question."

A Working Research Committee

About eighteen months ago, a committee on research was appointed. Meetings were held almost immediately. In work of this kind it is necessary that we have the full confidence of the membership, its sympathy and interest. Above all, a spirit of co-operation must be manifest. Without all of this the committee would work under a most serious and discouraging handicap. We are glad to report that the entire institute is behind the committee and it has been a pleasure to serve.

Uppermost in the minds of all was the desire to make a better product, then better and more economical methods of manufacture, and then a clearing house for suggestions and advice to members.

Gathering Data on Cast Stone Industry

The mode of procedure was becoming definitely crystallized in the minds of the committee. They decided that first, a fund of information was to be gathered, and the best way was found to be through the presentation of a questionnaire to each member—this questionnaire to be presented in person by one who had the confidence of the entire Cast Stone Institute. In this way no individual processes could be passed from one manufacturer to another. Some sixty questions were prepared which took considerable time because we wished them to be concise and correct. This questionnaire covered the broad headings of materials, mixing, molding, curing, finishing and minor headings of general interest. This plan involved an examination of the individual plants and their methods.

Studies to Be Undertaken

We expect to take up some definite studies, such as the selection of aggregates, a scientific use of cement and a definite mode of curing practice. It is also determined to study modes of manufacture aside from pure physical and chemical processes. We have in mind economical use of time, labor and machinery. In fact, the ultimate goal is a perfect product economically made.

This work is giving us confidence in our program of advertising, which is being favorably commented upon by leading architects. Research and advertising are closely linked together because advertising of the kind that we do encourages us to our best efforts, and the results of our research enthuse us to talk about our wares.

A Word for Those Who Helped

No one individual can be singled out for the work that has been done. All the members of the committee have been diligent and sincere, but I cannot close without expressing thanks for the inspiring thoughts of our president, Mr. Van de Bogart, the untiring work and guidance of our secretary, Mr. C. G. Walker, and the encouragement of our friend, Mr. W. D. M. Allan. The Cast Stone Institute expects positive results and the committee believes their confidence will not be in vain.

Condensed from paper read at the joint annual meeting of the Concrete Masonry Association and the Wisconsin Concrete Products Association, Milwaukee, Wis., February 23-24, 1931.

Sand and Gravel Group Takes on Work of Ready-Mixed Concrete Association

Conduct of the activities of the National Ready-Mixed Concrete Association has been undertaken and will be continued in the future by executive personnel of the National Sand and Gravel Association, but separate from that of the latter.

Stanton Walker has been appointed director of engineering and V. P. Ahearn will handle the duties of the executive secretary. Headquarters have been transferred to the Munsey Building, Washington, D. C.

Use Standardized Metal Forms for Concrete Foundation Walls

Rapid and Smooth Progress on Morgandale High School Project—Form Units Include Standard and Fractional Sizes and Special Corner Devices

By B. E. WILTSCHECK
Superintendent for Wm. M. Christensen Construction Co., Inc.

When concrete first came into use, wood was the only form material available, and many years elapsed before concrete became sufficiently important in large building operations to encourage engineers to consider the use of other materials.

It is probably true, as recently stated, that concrete form work is a bugbear with most contractors, and that the large majority of construction men consider the estimating of form work to be the most uncertain element in general construction work.

It is equally true that the element of uncertainty in cost of concrete form work will diminish as such work becomes standardized. In consequence, many readers will be interested in this new series of articles, of which this is the first installment, in which the use of standardized metal forms on a typical construction job is described.—The Editors.

THE construction of heavy concrete foundation walls and wall pilasters in the new Morgandale High School building in Milwaukee supplies a typical instance of the use of standardized metal forms in such work.

Some Advantages of Standardized Form Units

The writer feels that before going into a detailed description of the assembly, erection, removal and replacing of metal forms on the Morgandale High School job, a brief discussion of such forms will be in order.

Well-informed construction men agree that there is much uncertainty about the estimating of concrete form work. Any system or material that simplifies and standardizes form work will not only help to remove the uncertainty, but it will in all probability reduce the cost.

Making Planning of Form Work Easier

The use of simple and standardized form units is of further aid because such use leads naturally to advance planning of the work. It may even be said that the use of standardized units greatly simplifies the problem of planning, organizing and supervising form work.

Advance planning must be supplemented with a determination to see that the plans are carried out; and, in addition, labor crews must be organized and trained for the work. The crews must be so well trained that each man knows just what he is expected to do, and when he is expected to do it, if the full advantages of standardized units are to be realized.

Strength, Light Weight and Convenience

The form units themselves must be strong enough to avoid bulging, light enough to be easily handled, and so designed that they may be conveniently assembled and just as conveniently removed. The backbreaking labor involved in the handling, assembling and removal of large units, whether of wood or any other material, must be avoided if the drudgery is to be taken out of form work.

The writer believes that qualities such as strength, lightweight and convenience in standardized form units would be more thoroughly appreciated if contractors were to make motion studies of every movement and operation involved in the use of the old style wooden form work. What with hauling, storing, carrying to point of use, building,

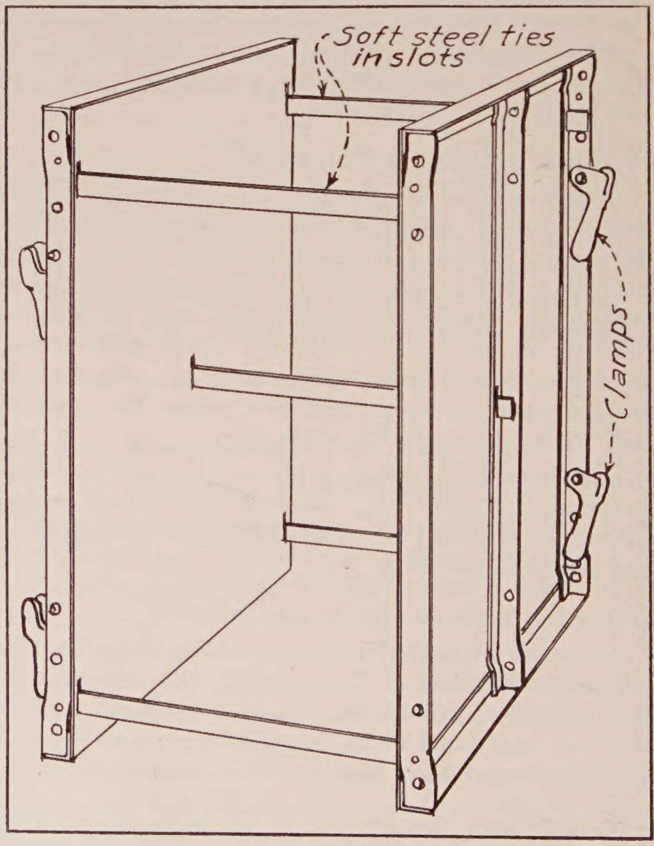


Figure 1. Details of 24 by 24-inch metal form unit

tearing down, rebuilding, discarding, salvaging, hauling away the wastage, contractors would begin to realize where their money goes.

Several Re-Uses on Same Project

The purchase or possession of sufficient material of any kind to construct forms for large-sized concrete wall projects presupposes enough use for the material to warrant an investment in it. Some contractors will need much more than others, owing to the size and character of their work, from season to season.

Too often, however, contractors are needlessly frightened at the cost per square foot of standardized metal forms, when a little reflection would show them that the actual cost of the form units per square foot is the original cost of the units divided by the number of times they are used.

Another point often lost sight of is the fact that the contractor gets several re-uses out of his forms on the same construction job. Consider the Morgandale High School job as an illustration. Here was a total contact form area of about 28,000 square feet in the foundation walls, but we used only about 56,000 square feet of metal forms. Consequently we obtained 5 uses on this project alone. This number of re-uses on the same project is made possible through proper scheduling of the concreting operation keeping in mind that in foundation wall construction the forms may be removed the day following the placing of concrete.

On the Morgandale High School job, as in others, we followed the practice of removing and re-setting the forms from day to day. A Wednesday morning, for illustration, found us with the forms set up for the day's run of concreting, and forms still in place where concrete was placed the day before. During Wednesday's run the forms were removed from Tuesday's run, moved forward and set up for Thursday's run. Similarly, on Thursday the forms were removed from Wednesday's run, moved forward, and set up for Friday's run.

Study of the schedule just described discloses that the amount of form material required in foundation wall construction is the amount needed for two days' run, for straight wall work.

When this project was completed the form units were cleaned and oiled and stored temporarily until the next job developed. For all practical purposes the units were as good as new, and should have many more re-uses to their credit.

The Form Units

The standardized metal form units used on the Morgandale High School job are owned outright by the contractor as a part of his construction equipment. The regular units are 24 inches square, made of sheet metal riveted on a stiffening frame of small angles. As shown in Figure 1, each of the regular units is punched with five narrow slots to receive steel spreader ties made of a soft, tough steel, and illustrated separately in the drawing. This regular unit weighs 20 pounds, though a second unit is made, of the same size but with heavier metal, that weighs 22 pounds.

Use of Fractional Units

Fractional units are made to provide an exact fit to the nearest inch. All fractional units are 24 inches high, made in the same way as the square standard unit, but in widths including every inch from 2 to 8 inches, inclusive, and all even inches from 8 to 22 inches, inclusive.

The fractional units are also employed in the last course at the top of the wall, except in rare cases where the height of the wall above its footing is an exact multiple of 2 feet. For instance, if the wall height is 10 feet and 7 inches above its footing, a 7 inch fractional unit (placed horizontally) will be clamped to the top of the last standard 24 by 24 inch unit.

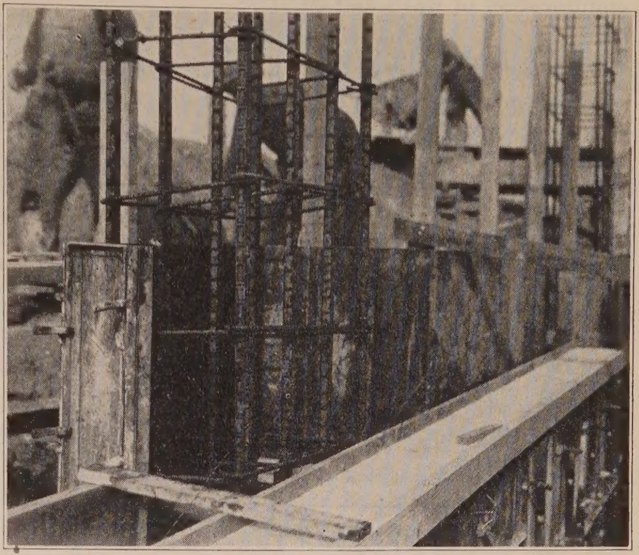


Figure 2. Forming the offset for a wall column or pilaster

All units, the fractional as well as the square, carry their own clamps and aligning lugs. The fractionals may be clamped either to the top or the sides of the regular 24 by 24 inch size.

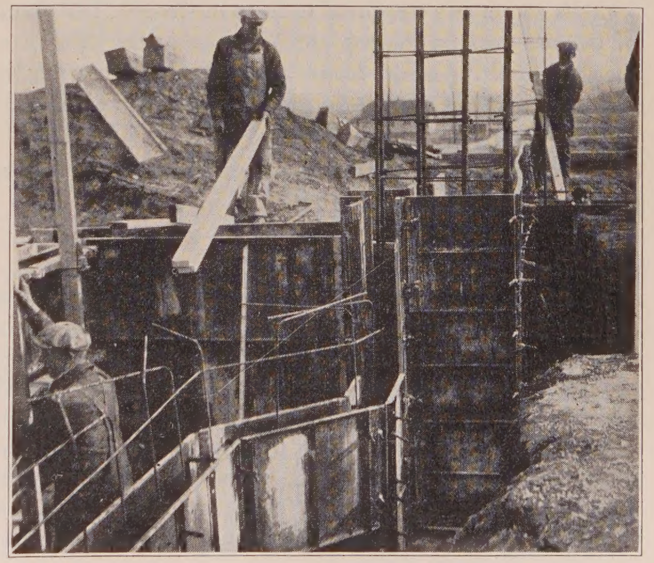


Figure 3. Use of fractional and full-size units in a complication of walls and columns

Forms Around Pilasters

Figure 2, from a photograph taken on April 10 on the Morgandale High School job, illustrates the use of fractional units in forming a wall column or pilaster. The offset in this case happens to be on the interior side of the wall. The column reinforcement is shown in place, and the fractional form units are in position on the inner side.

Figure 3, taken near a corner of the Morgandale project, shows the use of both fractional and full-size units in a complication of walls and columns.

Forming Ledges in Wall

When a ledge occurs in a wall, as in cases where the masonry veneer is to start, a wooden plank of suitable width is commonly employed to form the ledge. The plank, of course, rests on the top spreader ties at the outside of the wall, and the metal forms above the ledge rest on the inner edge of the plank. In the meantime the plank may serve as a footway for workmen.

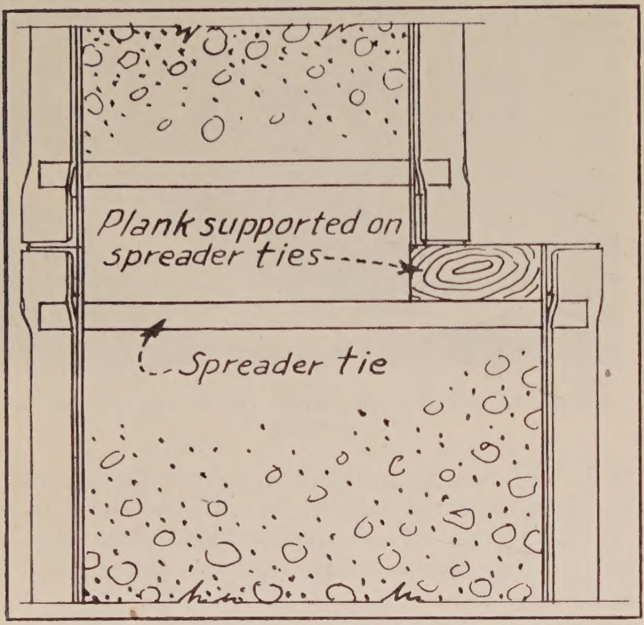


Figure 4. Forming a ledge in a wall

The forming of a ledge is shown in Figure 2, as well as in the sketch, Figure 4.

The Clamps

As shown in Figure 1, each unit (whether fractional or regular 24 by 24 inch size) has two clamps riveted to the stiffening angle along one edge. As there shown the clamps are unengaged. Only one "finger" of the clamp is riveted, the other finger remaining free to engage the next form unit. When the next unit is set up beyond, the clamp handle is pulled into a straight-out position, whereupon the free "finger" engages the stiffening angle on that unit. When forms are removed a light tap with an ordinary hammer releases a clamp.

Aligning Lugs

Figure 1 also shows the aligning dowels that aid in setting the form units. The holes in the stiffening angle to which the clamps are attached correspond to dowels in the angle on the opposite edge. As the next unit is set up beyond, the dowels in that unit fit into the holes of the unit already set up, thereby insuring proper alignment of the forms.

Devices for Corners

Special devices for use in outside and inside corners are shown in Figure 5.

As the drawing shows, the outside corner device is nothing more than an angle with two clamps attached. The angle is, of course, the same size as the stiffening angles of the units themselves.

The inside corner device consists of a 4 inch strip of sheet metal of the same material as the sheet metal in the form units, bent into an angle with a width of 2 inches on each leg. Stiffener angles are riveted to the edges of the strip, and two clamps are riveted to one of the stiffeners. This special device may then be clamped to the regular or fractional units in the usual way.

The hinged section (Figure 5) is employed at corners other than right-angled corners. It is made in a manner similar to the inside corner device, except that the legs are hinged, and horizontal mitered plates are welded to each arm of the hinge, at the top and bottom.

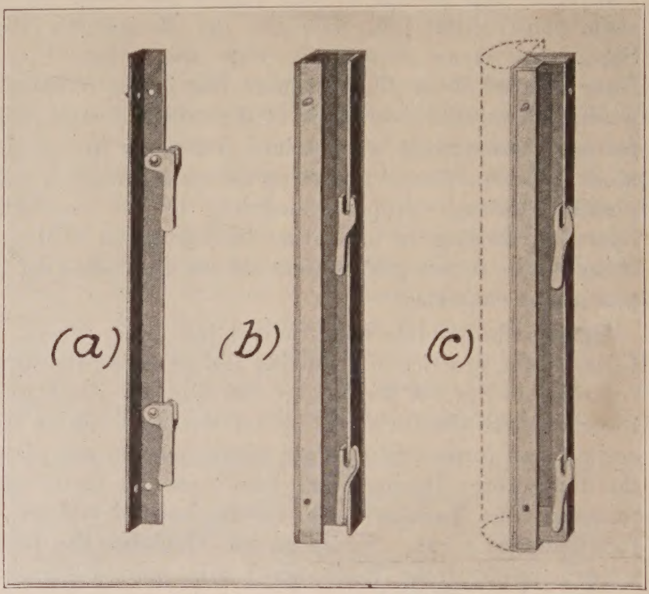


Figure 5. Special devices for corners. (a) represents the outside corner, (b) inside corner, and (c) hinged section.

The assembly operation, describing the manner in which the forms were assembled and erected in larger units on the Morgandale High School project, the use of "liners," bracing, and other details, will be described and illustrated in the next article.

Final Article on Movable Forms Coming Later

The third and final installment of Richard T. McKay's articles on details of movable forms and their operation, promised last month for the June issue, will be published later.

This final contribution will deal with the removal of moving forms on structures such as circular tanks.

Placing Sand-Haydite Concrete Under Strict Field Control

Comparative Data Show Saving in Cost and Weight Due to Light-Weight Aggregate—Cold Weather Operations—Test Results Show Ample Strength

By E. B. WHITE
In Charge of Architectural Department of Y.M.C.A., Chicago

THE superstructure of the Victor Lawson Memorial Y.M.C.A. Building, located at Chicago Avenue and Dearborn Street, Chicago, is of structural steel-frame design and light-weight concrete for fireproofing and slab construction. The concrete aggregates are torpedo sand and haydite coarse aggregate, the latter furnished by the Western Brick Company, of Danville, Illinois.

Comparison Between Sand-Haydite and Ordinary Concrete

Sand-and-haydite concrete weighs approximately 80 per cent of the weight of ordinary concrete. Therefore, its use reduces the dead load considerably and effects noticeable savings in both the reinforcing steel and the structural steel members.

TABLE 1

Comparative Cost of Ordinary Concrete as Compared to Haydite Concrete

1:2:4 mix, with sand and stone (dry, loose)

1.50 bbl. cement	@ $2.20	$3.30
.44 yd. sand	@ 1.50	.66
.89 yd. stone	@ 1.65	1.47
Total (exclusive of labor)		$5.43

1:2½:3½ mix, with torpedo sand and haydite for coarse aggregate (dry, loose)

1.48 bbl. cement	@ $2.20	$3.26
.55 yd. sand	@ 1.50	.83
.77 yd. haydite	@ 5.75	4.43
Celite*		.40
Total (exclusive of labor)		$8.92

*Celite specified to be used with haydite.

6,000 cu. yd. haydite	@ $8.92	$53,520
6,300 cu. yd. concrete	@ 5.43	34,209
Excess cost of sand-haydite concrete		$19,311

TABLE 2

Savings Effected by the Use of Haydite Concrete

80 tons reinf. steel	@ $70	$ 5,600
233 piles	@ 27	6,291
250 tons struc. steel	@ 80	20,000
Savings resulting from decreased wgt. due to use of haydite concrete		$31,891
Excess in cost by the use of haydite concrete		19,311
Net savings		$12,580

		Pounds
6,300 cu. yd. concrete	@ 3,884 lb.	24,494,000
6,000 cu. yd. haydite concrete	@ 2,916 lb.	17,496,000
Saving in weight		6,998,000

Field Supervision and Inspection

The inspection of materials and concrete field supervision service was rendered by the Robert W. Hunt Company, consulting and testing engineers, of Chicago.

TABLE 3

Field Analysis of Aggregates and Design of Mixes

Fine Aggregate:	
Fineness modulus of torpedo sand	3.30
Unit weight in lb. per cu. ft.	112.00
Absorption, per cent	1.00
Specific gravity	2.66
Coarse Aggregate:	
Fineness modulus of haydite	6.22
Unit weight in lb. per cu. ft.	47.00
Absorption, per cent	11.00
Specific gravity	1.39

The designed mix to produce a 2,000-lb. concrete was 1-2.7-3.25, dry and loose, allowance having been made for the bulking of aggregates.

Water-Cement Ratio; Yield

In order to determine the correct water-cement ratio it was necessary to ascertain the amount of water carried by the aggregates, the amount of water absorbed by the haydite and by the 3 pounds of celite per bag of cement.

The average cubic foot of torpedo sand contained 0.31 gallons of water. The haydite as received on the job absorbed an additional 2 pounds of water, or 0.25 of a gallon, per sack of cement. The 3 pounds of celite absorbed 4½ pounds of water, or 0.54 of a gallon, per sack of cement.

The water used in the mix, including the water in the aggregate, was 8.35 gallons; and subtracting 0.79 of a gallon for absorption left a net amount of 7.56 gallons of water per sack of cement. This was equivalent to a water-cement ratio of 1.01 and produced an average slump of 7¼ inches.

The concrete was mixed in the mixer for 1 minute and 20 seconds at 18 r.p.m.

The actual yield per sack of cement was 4.73 cubic feet of concrete, so that the cement content was 1.42 barrels per cubic yard of concrete.

TABLE 4

Savings Effected for the Contractor Due to the Use of Field Supervision Service

1.42 bbl. cement @ $2.20	$3.12
.57 yd. sand @ 1.50	.87
.70 yd. haydite @ 5.75	4.02
Celite	.40
Total	$8.41
Estimated cost of concrete	$8.92
Actual cost of concrete	8.41
Savings effected (exclusive of labor), per cu. yd. of concrete	$0.51

Delay in Steel Erection Halts Progress

The first floor slab was concreted in the early part of September and then the concrete work was stopped to permit the erection of the structural steel frame; but due to some changes in the structural drawings and various other delays, the erection of the structural steel frame work was not begun until the latter part of September.

It was not until the latter part of October that the second and third floors were framed and ready for concreting, and by this time cold weather had set in. It was necessary to heat the aggregates and the water and to cure the concrete with the use of salamanders and tarpaulins.

Before a slab was concreted the floor above had to be framed and the tile and reinforcing steel set in place. Tarpaulins were then hung around the entire building in such a manner that two floors were completely enclosed, namely, the floor below the one being concreted and the floor slab itself. Sufficient salamanders were placed under the floor slab to insure a temperature of not less than 65 deg. F. and not more than 100 deg. F. for curing. The temperature on the top of the slab was always kept above 40 deg. F., even when the temperature outside was as low as 15 deg. No concrete was placed when the outside temperature fell below 15 deg. F., and only ten days were lost on account of cold weather.

Place 2½ Stories Per Week

The concreting progressed at the rate of two and one-half floors per week after the third floor slab had been placed. The average temperature of the concrete the time of its placing was 68 deg. F.

Job Control and Laboratory Cylinders

Three sets of 6 by 12-in. cylinders were made each day for testing at 7, 14 and 28 days. The 7 and 14-day cylinders were used for job control and remained on the job for 6 and 13 days, respectively, and were then shipped to the Robert W. Hunt Company concrete laboratory for compression tests. The 28-day cylinders were sent to the laboratory approximately 36 hours after casting and placed in a moist room where conditions were held at 70 deg. temperature and saturated humidity until the date of testing. The 7-day cylinders determined whether or not sufficient heat had been given the concrete in its curing; the 14-day cylinders were the criterion for the removal of shoring and form work.

The following test results were obtained on concrete cylinders:

Age of Specimens	Compressive strength, lb. per sq. in. Average	High	Low
7 days	1,340	2,200	850
14 days	1,650	2,400	1,200
28 days	2,700	3,148	1,946

The following test results were obtained on cement briquettes:

Age of Specimens	Tensile strength, lbs. per sq. in. Average	High	Low
7 days	390	470	360
28 days	490	520	440
Fineness of cement	92.4	97.9	88.9

Results of Tests

Referring to the chart, it will be noted that where the cement was high in tensile strength at 7 days the compressive results of the concrete cylinders were also high at that period, but the 28-day test results had gained very little. The fineness test of the cement seems to indicate that where the 7-day test results were high the fineness ran fairly high. Where the fineness was low the 7-day test results were low, but the 28-day test results showed a decided increase over the 7-day.

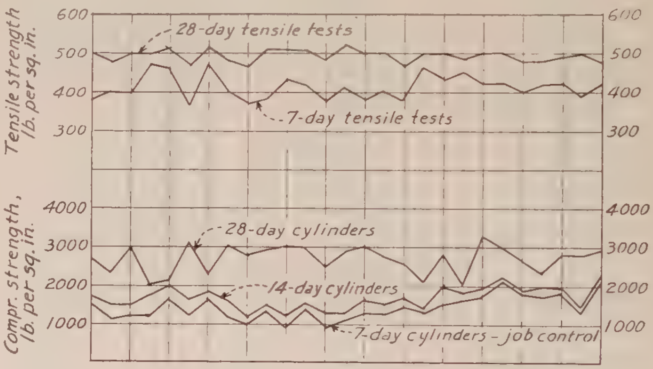


Chart showing relation between the tensile strength of the cement and compressive strength of the concrete

Acknowledgments

In addition to the concrete field supervision rendered by the Robert W. Hunt Company, we also used their structural steel field erection service as well as mill manufacture and shop inspection of the fabrication of this steel.

The architects of this building were Perkins, Chatten & Hammond, of Chicago; the general contractor was Jacobson Brothers, and the concrete contractor was J. C. Jensen, both of the same city. Frank A. Randall, of Chicago, was structural engineer, and the Overland Construction Company was the steel erector.

American Road Builders' Association Proceedings in New Form

The proceedings of the American Road Builders' Association this year are published according to a new plan. Instead of complete reports, summaries and conclusions only are presented. The full reports are published as bulletins.

Fire-Resistive Values of Concrete and Concrete Masonry Units

Requirements for Walls, Partitions, Columns and Other Structural Parts Given in New Report by Department of Commerce Building Code Committee

A NEW report has been added to those previously issued by the Department of Commerce Building Code Committee.

This latest report, published under the title of "Recommended Minimum Requirements for Fire Resistance in Buildings," classifies buildings into six general types of construction. A brief description of each of these six types will help to fix them in mind.

Type 1.—Fully Protected Construction. This is the highest fire-resistive type, corresponding to what is termed fireproof construction in many city building codes. Walls are of masonry or reinforced concrete, and structural parts and members are of incombustible materials having an ultimate fire resistance sufficient to withstand the standard fire hazard for a period of at least 4 hours in bearing walls, fire walls, party walls, piers, columns, trusses, and for girders which support walls; 2½ hours in other walls and girders, and in floor and roof construction, including beams and girders; and 1 hour in partitions, provided further that no combustible material shall be used in the construction of partitions.

Type 2.—Protected Construction. This type includes buildings in which walls are of masonry or reinforced concrete, and structural members and parts are capable of withstanding the standard fire hazard for a period of at least 4 hours in fire walls and party walls; 3 hours in bearing walls, piers, trusses other than roof trusses, and in columns and girders supporting walls; 2 hours in other walls, columns and girders; 1½ hours in floor and roof construction, including beams and girders, and in roof trusses; and 1 hour in partitions.

Type 3.—Heavy Timber Construction. This type includes the type referred to in many building codes as slow-burning, or mill construction.

Type 4.—Masonry Wall and Joist Construction. Many building codes classify this type as "ordinary" construction. Exterior walls are of masonry or reinforced concrete, and the interior framing is partly or wholly of wood, or of unprotected iron or steel.

Type 5.—Wood Frame Construction. Wood frame construction, of course, includes that in which the structural parts and materials are of wood.

Type 6.—Unprotected Metal Construction. Unprotected metal construction is that in which the supporting structural frame is of unprotected metal, and in which the exterior walls and roof are of sheet metal or other incombustible material.

Materials Approved as Fire-Resistive Construction

In the appendix the committee indicates specifically the materials of construction and methods of assembly that are approved or recommended for the various fire-resistive periods ranging from 4 hours down to 1 hour.

It is especially noteworthy that hollow and solid concrete building and fireproofing units are given full recognition as fire-resistive materials, and that the thicknesses and methods of assembly recommended compare favorably with the requirements designated for competitive materials. It will suffice here to enumerate the requirements for concrete and concrete products alone. For exact comparisons with competing materials the full report should be consulted.

REQUIREMENTS FOR WALLS

The requirements that follow are recommended as sufficient to withstand the standard fire hazard for periods of 4, 3, 2½ and 2 hours, respectively, in walls.

Four-Hour Walls

Eight inches of solid brick (including concrete brick), plastered or unplastered.

Twelve inches of hollow walls of brick (including concrete brick), plastered on both sides.

Eight inches of one-piece hollow concrete block, shells and webs at least 1½ inches thick, plastered on both sides.

Twelve inches of one-piece hollow concrete block, containing not less than two cells in the thickness of the wall, plastered or unplastered.

Four inches of hollow concrete block, faced with 3¾ inches of brick, limestone or terra cotta, plastered on one side.

Eight inches of hollow one-piece concrete block, faced with 3¾ inches of brick, limestone or terra cotta, plastered or unplastered.

Six inches of solid reinforced concrete, reinforced in both directions with not less than four-tenths of 1 per cent of steel, and with the maximum size of the coarse aggregate not exceeding ¾ inch.

Three-Hour Walls

Any of the above, or the following:

Eight inches of one-piece concrete block, shells not less than 1½ inches thick, oval cores, coarse and fine aggregate of burned shale or clay, unplastered.

Eight inches of one-piece cinder concrete block, shells not less than 2 inches thick, unplastered.

Eight inches of one-piece concrete block, coarse aggregate limestone or calcareous gravel, shells not less than 2 inches thick, unplastered.

Eight inches of one-piece concrete block, shells not less than 1½ inches thick, plastered on one side.

Six inches of one-piece cinder concrete block, shells not less than 2 inches thick, plastered on both sides.

Four inches of one-piece concrete block, faced with 3¾ inches of brick, limestone or terra cotta, plastered or unplastered.

Twelve inches of concrete block containing one cell in the thickness of the wall, plastered or unplastered.

Five inches of solid reinforced concrete, with four-tenths of 1 per cent of steel in both directions, and ¾-inch maximum size of coarse aggregate.

Two and One-Half Hour Walls

Any of the above, or the following:

Eight-inch hollow walls of brick (including concrete brick), plastered or unplastered.

Eight inches of concrete block, shells not less than 2 inches thick, unplastered.

Eight inches of concrete block, shells not less than 1½ inches thick, coarse aggregate limestone or calcareous gravel, unplastered.

Two-Hour Walls

Any of the above, or the following:

Eight inches of concrete block, shells not less than 1½ inches thick, unplastered.

PARTITIONS

Partition thicknesses refer to the total thickness of the construction. Where plastering is required, but no thickness given, it should be portland cement or gypsum plaster at least ½-inch thick. The height of a partition shall not exceed 30 times its thickness unless it is rigidly anchored at the top and bottom.

Two-Hour Partitions

Single thickness of brick (3¾ inches), including concrete brick, plastered on both sides.

Four inches of concrete block, plastered on both sides.

Four inches of solid reinforced concrete, with four-tenths of 1 per cent of steel in both directions, maximum size of aggregate ¾ inch, unplastered; or 3 inches thick if plastered on both sides.

One-Hour Partitions

Any of the above, or the following:

Brick, (including concrete brick), 3¾ inches thick, unplastered.

Four inches of cinder concrete block, unplastered.

Three inches of cinder concrete block, plastered on both sides.

Three inches of solid reinforced concrete, unplastered (reinforcement and maximum size of aggregate as above).

Solid portland cement plaster, 2½ inches thick, on expanded metal or wire lath on incombustible studding.

Hollow partition of ¾-inch portland cement plaster on expanded metal lath or wire lath on each side of incombustible studding, or on expanded metal or wire lath on each side of combustible studding.

FIREPROOFING FOR STEEL COLUMNS

In steel column fireproofing, all interior or re-entrant spaces shall be filled either with concrete or with the same material as the protection, except where specified otherwise. Where the material and thickness of plastering are not given, the plastering shall consist of at least ½ inch portland cement or gypsum plaster.

Four-Hour Steel Column Protection

Two inches of concrete, coarse aggregate limestone, calcareous gravel, trap rock, blast-furnace slag, burned shale or clay.

Concrete 2½ inches thick, on wire ties or metal mesh reinforcement, when coarse aggregate is granite, sandstone or cinders.

Concrete 3 inches thick, on metal mesh reinforcement, when coarse aggregate is siliceous gravel.

Brick (including concrete brick) 3¾ inches thick, with brick fill.

Four inches of hollow concrete tile, well anchored or bonded, plastered, with coarse aggregate calcareous gravel, trap rock, blast-furnace slag, or burned clay or shale.

Two 2-inch layers of hollow concrete tile, well anchored or bonded, plastered.

Three inches of solid cinder concrete block, well bonded or anchored, plastered.

Four inches of hollow cinder concrete block, well anchored or bonded, plastered.

Three-Hour Steel Column Protection

Any of the above, or the following:

Two inches of concrete, with wire ties or metal mesh reinforcement, coarse aggregate sandstone, granite or cinders.

Two inches of solid cinder concrete block, well anchored or bonded, and plastered.

Two-Hour Steel Column Protection

Any of the above, or the following:

Concrete 1½ inches thick, coarse aggregate limestone, calcareous gravel, trap rock, blast-furnace slag, burned shale or clay.

Concrete 1½ inches thick, with wire ties or metal mesh reinforcement, coarse aggregate sandstone, granite or cinders.

Concrete 2 inches thick, with wire ties or metal mesh reinforcement, coarse aggregate siliceous gravel.

Brick (including concrete brick) on edge, 2¼ inches thick, outside wire ties.

Two inches of solid cinder concrete block, well anchored or bonded, plastered or unplastered.

Two ⅞-inch layers of portland cement plaster on expanded metal or wire lath, with ¾-inch air space between.

One-Hour Steel Column Protection

Any of the above, or the following:

Concrete 1 inch thick, coarse aggregate limestone, calcareous gravel, trap rock, blast-furnace slag, burned shale or clay.

Concrete 1½ inches thick, with wire ties or metal mesh reinforcement, coarse aggregate granite, sandstone, cinders, or siliceous gravel.

Brick (including concrete brick), on edge, 2¼ inches thick, with brick fill.

Two inch hollow concrete tile, well anchored or bonded, no fill.

One inch of portland cement plaster on expanded metal lath, no fill.

Fire-Protection of Other Structural Members

The thickness of concrete protection over steel beams and girders, reinforced concrete columns, beams and girders, and reinforced concrete floor slabs, is quite well in line with the usual building code requirements, and the figures need not be enumerated here. As before, a distinction is made between coarse aggregates, materials such as limestone, calcareous gravel, trap rock, blast-furnace slag, and burned shale or clay being given preference over materials which are believed to undergo greater expansion than the materials just named, when exposed to intense heat.

Minneapolis Products Manufacturers Elect Officers

C. V. Carlson was elected president of the Concrete Block Manufacturers Association of Minneapolis at the annual election meeting of the board of directors recently. Edward O. Johnson was named vice-president and Robert A. Anderson as secretary and treasurer.

EDITORIAL

Full Recognition for Concrete Masonry Units

THE series of load and stability tests of full-size concrete masonry wall panels and a number of smaller wallettes, made at the University of Illinois under a co-operative arrangement with the Concrete Masonry Association, constitutes the first important research activity of the association since its reorganization early in 1930.

The wall tests, which are to be reported at the forthcoming annual meeting of the American Society for Testing Materials, also constitute the most important move made by the concrete masonry industry since the series of fire tests were made at the Underwriters' Laboratories.

Just as the Underwriters' Laboratories fire tests compelled gradual recognition of concrete masonry building units in the making of fire insurance rates, so will the University of Illinois tests supply much needed information of the kind that is useful in gaining full recognition for concrete masonry construction in city building codes.

Coupled with the proposed A. S. T. M. specifications and tests for load-bearing concrete masonry units, also to be presented at the annual meeting of that society, the industry will now have an impressive amount of data to support its claims. Framers of new or revised building codes can no longer turn thumbs down on concrete masonry units on the pretext that this material has not received recognition from the A. S. T. M.

Every manufacturer of concrete masonry building units has something definite to gain from the results of the University of Illinois tests; but manufacturers must not forget that much remains to be done. The results of the tests and the proposed or tentative A. S. T. M. specifications must be given recognition by city building codes before restrictions still existing in many codes are removed.

This work, as well as the solution of other research problems, must be supported. Now that a good start has been made there is no turning back.

An Acknowledgment to Highway Departments

THE nation will give grateful recognition to the ability and energy of state highway departments, whose combined total of concrete highway contracts awarded during the first four months of this year amounts to 57 million square yards. This figure compares with 36 million square yards of concrete highway pavements awarded in the first four months of last year, and 23 million square yards in 1929.

It was not without well organized effort and wise planning ahead that this enormous expansion in concrete highway construction has been accomplished, for only a part of the increase is the result of increased income.

Avoiding Trouble for Ready-Mixed Concrete

FROM two cities, each with a population just above a hundred thousand, word reaches us of the recent completion of the second ready-mixed concrete plant. In each city the first plant was in operation for three or four years before the second one was built.

No one can have any valid objection to the installation of the second plant, provided its owners have built a plant that is well financed and properly equipped for the production of quality-controlled concrete, and provided further that enough business is in sight for the two plants.

If, on the other hand, the second installation is merely splitting a one-plant business with the original plant, grief may be the lot of each.

There is danger in the possibility that the production of ready-mixed concrete may catch the popular imagination, with the inevitable result that two or three plants, some of them perhaps poorly financed, will spring up in every one-plant town. It will be fortunate if manufacturers of equipment will co-operate with the ready-mixed concrete industry with the view of preventing the development of such situations, so far as they can be prevented.

Much can be accomplished through the dissemination of data concerning the industry, of the nature of the pamphlets and mimeographs recently distributed by the National Ready-Mixed Concrete Association.

Such data should offer convincing proof that the ready-mixed concrete business is no place for the inexperienced, and that a plant can not be operated on a shoestring. As pointed out in an article in the March (1931) issue of "Concrete," page 19, a heavy investment is required, running from $3 to $5 per cubic yard of concrete delivered yearly, for the plant and trucks alone. In addition, a substantial working capital is required.

Likewise, the production of the concrete itself involves a thorough understanding of the technical aspects of strength control, density, yield, and related matters.

If these facts are given wide publicity this lusty young industry will attract men with demonstrated business ability, thus avoiding some of the troubles that beset so many others.

PROGRESS—In a Page

◀ **Current activities in research, in matters pertaining to concrete and cement, as being carried on or completed by various organized groups.** ▶

Production and Use of Ready-Mixed Concrete

The National Ready-Mixed Concrete Association now has available for distribution several mimeographs and printed pamphlets, each dealing with some phase of the production, delivery or use of ready-mixed concrete.

The list of publications includes the following three printed pamphlets:

Estimating Quantities of Concrete, by Stanton Walker, director of engineering, National Ready Mixed Concrete Association, Washington, D. C.

Pre-Mix Concrete from the Viewpoint of the User, by Henry D. Johnson, designing engineer, Bureau of Bridges and Structures, Pittsburgh, Pa.

The Proportioning of Concrete for Strength, Durability and Impermeability, by A. T. Goldbeck, director, Bureau of Engineering, National Crushed Stone Association, Washington, D. C.

Four mimeographs, two of which have not yet been released for distribution, cover various phases of specifications, plant operation and transportation problems. Following is a list of the mimeographs:

Strength Specifications for Ready-Mixed Concrete, by J. L. Shiely, J. L. Shiely Company, Inc., St. Paul, Minn.

Central-Mix Concrete in Philadelphia, by H. J. Whitten, Warner Company, Philadelphia, Pa.

Effect of Haul on Strength of Concrete (describes results of few tests carried out by J. L. Shiely Company, St. Paul, Minn.; not yet released for publication).

Effect of Period of Agitating Ready-Mixed Concrete. (Describes results of tests carried out by Thompson and Lichtner Co., Inc., Boston, Mass., for the Boston Concrete Corporation; not yet released for publication.)

Copies of these publications may be obtained by addressing V. P. Ahearn, executive secretary, National Ready-Mixed Concrete Association, Munsey Building, Washington, D. C.

Strength and Stability Tests of Walls of Concrete Masonry

A series of load and stability tests on walls of concrete masonry units have been made at the University of Illinois, working in co-operation with the Concrete Masonry Association.

The test walls included 51 panels of full story-height, each 9 ft. 4 in. high and 6 ft. wide, and 40 smaller panels, or wallettes, each 4 ft. high and 2 ft. 8 in. wide. Several hundred tests on individual units were made.

The results of these tests are to be given in a report to be presented at the forthcoming annual meeting of the American Society for Testing Materials by Prof. F. E. Richart, under whose direction the tests were made.

Manufacturers of Metal Lath Adopt Certification Plan

Members of the Associated Metal Lath Manufacturers, both individually and as a trade association, have adopted the certification plan sponsored by the U. S. Department of Commerce, acting through the Bureau of Standards.

In taking this action the manufacturers signify their willingness to comply with the requirements of the Federal master specifications.

Under the certification plan any public official, architect, building owner or contractor who desires uniformity of bidding and the assurance of high quality products, merely requests the manufacturers to state in their bids that they are willing to certify that their products will conform with the Federal Master Specifications which govern metal bases for plaster and stucco. Upon receiving this assurance he will thereupon request the successful bidder to tag materials shipped for the specified contract, indicating thereon that they are manufactured in accordance with the Federal Master Specification described above. Shipments which do not conform with these requirements should be rejected. Furthermore, any architect or owner can secure the same quality of materials for plastering bases as is required by the federal government, by merely stating that a condition necessary to the acceptance of a bid for furnishing lath shall be the manufacturer's agreement that he will certify that this product meets the Federal Master Specification requirements.

More complete information may be obtained from Erwin M. Lurie, executive secretary, Associated Metal Lath Manufacturers, 205 W. Wacker Drive, Chicago, Ill.

Adopt Federal Specifications for Cement and Waterproofing

THE following specifications for portland cement, masonry cement, and integral waterproofing have been officially adopted and promulgated by the Federal Specifications Board, Bureau of Standards, Washington, D. C.:

Symbol	Title	Mandatory Date
SS-C-191	Portland Cement	May 15, 1931
SS-C-181	Masonry Cement	June 1, 1931
SS-W-101	Use of Integral Waterproofing Material with Portland Cement Mortar or Concrete	June 1, 1931

On the dates indicated these specifications become mandatory as purchase specifications upon all departments and independent establishments of the government.

Copies of the specification on portland cement may be obtained at 10 cents each, and of the others at 5 cents each, from the Superintendent of Documents, Government Printing Office, Washington, D. C.

How Bulk Cement Is Handled in Highway Paving Work

Carts, Conveyors and Pneumatic Pumps Are Some of Means Employed—Use of Bulk Cement on Increase—Trouble With Hot Cement

This article, the third of a series that started in the April issue, sets forth the practice of various state highway departments in the handling of bulk cement.

The use of bulk cement in highway paving work is clearly on the increase, and handling methods will in time become standardized. —The Editors.

THE increasing use of bulk cement in concrete highway construction practice is indicated from the replies received from state highway departments in response to an inquiry addressed to them by CONCRETE.

Out of 26 state highway departments reporting, eleven have had satisfactory experience with the use of bulk cement. Two of these eleven states—Wisconsin and Oklahoma—used bulk cement on all work in 1930.

Handling Bulk Cement on Paving Work

The most interesting feature involved in the use of bulk cement on paving work is the practice followed in handling the material.

W. C. Buetow, State Highway Engineer, Madison, Wisconsin, describes the methods of handling in that state. "During 1930," he writes, "the state furnished the cement, and specifications were written to provide that cement would be shipped in bulk to the contractor. Most of the bulk cement was handled at the material yard and weighed in push buggies as it was taken from the cars. Some had it hauled from the siding to their storage yards and then hoisted into a compartment of the bin for their aggregates. In some instances the same clamshell that handled the aggregates also handled the cement. This last method we do not like, and we do not now approve it. Others loaded the cement from the cars by an elevator into a hopper, and then to the weighing device by gravity."

C. M. Hathaway, Engineer of Construction, Illinois Division of Highways, states that the use of bulk cement is still new in their department, but that the method was employed satisfactorily on four or five paving jobs during 1930. In general, the contractors use a pneumatic loading duct for pumping the cement from the cars to the bins. Then it is carefully weighted into the transportation unit, together with the aggregates.

"In Arkansas," writes W. W. Zass, Engineer of Construction for the State Highway Commission, "bulk cement has been used to a considerable extent during 1929 and 1930. We have found it quite satisfactory and believe we can be more nearly sure of obtaining the full cement content from the use of bulk cement than from sacked cement. In some instances bulk cement was handled directly from the car into proportioning bins and then to the trucks. In other instances it was handled from the cars to carts, the carts were weighed on platform scales, and the contents were then deposited into the trucks. Under either method the results have been satisfactory."

J. D. Monette, Office Engineer, Mississippi State Highway Department, mentions the use of separate containers for hauling bulk cement on paving work. In Nebraska, according to A. T. Lobdell, Chief of the Bureau of Roads and Bridges, the practice is to weigh the cement in concrete carts and dump it into trucks through a chute having canvas tacked on the bottom.

H. P. Chapman, Chief Engineer of the Bureau of Construction, Ohio Department of Highways, writes that their general practice is to handle bulk cement in car containers. In Oklahoma, one of the states where bulk cement was used on all highway work in 1930, no special method of handling has been developed. The material is weighed by hand, according to Guy H. James, Assistant Construction Engineer for the State Highway Commission.

Trouble With Hot Cement

Gibb Gilchrist, State Highway Engineer, Austin, Texas, mentions trouble with hot cement fresh from the mills. "Our chief trouble with bulk cement," he says, "has been in cases where the mills have given us hot cement. If the temperature of the cement runs above 120 deg. F. and we have hot water for mixing, we often get a flash set on the concrete, which usually ties up the work. This hot cement also causes rapid evaporation of mixing water immediately after discharge from the mixer, which seriously impairs the workability and hampers the finishing of the concrete."

In handling bulk cement Mr. Gilchrist states that on one paving project they used a standard batcher bin with weighing equipment which discharged directly into aggregate trucks that hauled the material to the mixer on the road. In other cases they used an ordinary concrete buggy which was passed over a set of platform scales where the contents were adjusted to a uniform weight. He recommends the latter method as the more economical from the installation and operating standpoints.

Bulk Cement With Central Mixing Plants

The use of bulk cement where central mixing plants are used in highway construction presents no new problems. The cement is handled much as it is in a commercial ready-mixed concrete plant. Such an instance is described by William J. Titus, Chief Engineer of the Indiana State Highway Commission, on a project where the concrete was supplied by a commercial plant. The cement was unloaded by a combination of scraper, screw conveyor and bucket elevator, and the cement was measured by weight for each batch.

T. G. McCrory, Chief Engineer of the Washington State Department of Highways, mentions the use of bulk cement on bridge work, but thus far his department has not employed it on paving work.

Profitable Manufacture of Concrete Building Units

Effecting Savings in Cement and Coal Handling—Material Volumes That Justify Extensive Mechanical Equipment—Importance of Well-Graded Aggregates to Economy

VI—Handling and Storage of Raw Materials

Part III

By FRED A. SAGER
Consulting Industrial Engineer

To make his analyses of raw material handling methods complete, the author of this series, Fred A. Sager, now deals with the cement and fuel.

Other subjects to be covered in the future include the manufacture of the product, storage and delivery, simple office and sales records, and sales and market analysis.

IN previous articles, the costs of handling aggregate have been analyzed in some detail and it is understood that the same methods are applicable and should be used in connection with the other raw materials, cement and fuel. As is clearly indicated in Diagram 9 (May issue of CONCRETE, page 22), the use of expensive mechanical equipment to save direct labor costs is justified only when a certain volume of material is handled per year.

In the case in hand, with the assumed annual production of 340,000 equivalent units, the quantities of raw materials are 10,200,000 lbs. of cinders, 2,000,000 lbs. of cement and from 300,000 to 400,000 lbs. of coal. The quantity of cement is one-fifth that of the aggregate and the coal is one-fifth the quantity of cement. From the curves of Diagram 9, it appears that the saving in cost per 1,000 lbs. of cinders handled is 13 to 15 cents, when handled in the above quantity per year (production of 340,000 units per year) and the annual saving will then be $1,326.00, which is worth consideration. If the same saving were effected per thousand pounds for the cement, the annual saving would be only one-fifth, on account of the smaller volume handled. Further reference to the curves of Diagram 9 will indicate that with one-fifth the volume handled, the saving per unit will be decreased to 2 or 3 cents per 1,000 lbs., which would total from $40.00 to $60.00 a year and probably would not warrant the installation of expensive equipment.

Saving in Cement Handling

A complete analysis of the costs of handling the other raw materials will not be made here, but the matter will be dismissed with a brief reference to possible methods of handling and approximate costs. Cement may be received by truck from the local dealer, in which case the price covers the material delivered at the point of use alongside the mixer. In case the cement is received by carload the expense of unloading is to be considered. If this is done in the simplest way, by men carrying the bags of cement from the car, over convenient runways to the storage, say a distance of 50 feet, the cost will be about ⅔ cents per bag or 06.6 cents per 1,000 lbs.

At this point attention should be called to the difference between the cost of hand work in handling package goods and bulk materials, the cost of shoveling cinders from the car having been estimated as 12.5 cents per 1,000 lbs., while the cost of handling coal from car to bins alongside the track will be taken below as 15 cents per 1,000 lbs. If the cement is loaded on a truck with a flat deck, 18 or 20 ft. high, large enough to conveniently carry 25 or 30 bags, and a runway is provided from the car floor to the storage space, the number of bags unloaded per hour can be increased from the 108 estimated for carrying by hand, to about 300 bags per hour, or a cost of 0.25 cents per bag for direct labor. The overhead cost in this case is practically negligible, being the interest and depreciation and maintenance on the truck and the runway construction. If this charge is taken at 15 per cent on $100.00, or $15.00 per year, the charge per bag is 0.075 cents and the total cost per bag is then 0.325 cents per bag. The annual saving in thus handling the cement, is in round numbers 0.3 cents times 20,000 bags or $60.00 per year.

Inclined Runway Often Used

In case the mixers are on the second floor and the cement has to be elevated to such location from the car, the cost of carrying by hand would be considerably increased. Mechanical elevating equipment would be considered, if the volume were large enough to warrant it. In some plants this situation has been met by the construction of an inclined runway, over which the cement is carried by hand or in wheelbarrows. In such case the cost per bag should be about 1 cent for labor.

If an inclined belt conveyor is installed at a cost of about $300.00 and the rate of handling be raised from 60 bags per hour for one man wheeling to 300 bags per hour for two men with the conveyor, the labor charge is reduced to 0.5 cents per bag, to which should be added the overhead charge on the investment, say 15 per cent. On $300.00, $45.00 per year or 0.225 cents per bag, bringing the total cost to 0.725 cents per bag. The saving per bag over hand work is 0.275 cents and the annual saving is $55.00, all of which indicates that we are nearing the limit of the use of expensive mechanical equipment as the volume of material handled becomes smaller.

As this point is reached, the opportunity of adapting simple and inexpensive means in saving labor should be considered. For example, for the handling of the cement just considered, arrange an inclined runway suitable for the operation of the flat deck truck referred to above. The truck can be taken into the car, loaded directly, even when the car is nearly empty (thus avoiding the longer carry when the conveyor is used and the car is nearly empty), drawn by hand to the bottom of the incline, up which it is drawn by cable operated from a friction pulley, then by hand to the storage pile. With 2 men operating in this manner, from 375 to 400 bags can be handled per hour at a cost of $1.50, on the assumed labor rate, at a cost of 0.4 cents per bag for labor.

Saving in Coal Handling

From the above it is evident that not much can be expected in the way of reduction of costs of handling the remaining raw material, the coal. From three to four cars per year amount to 300,000 or 400,000 pounds, which if shoveled directly into the bin alongside the track will cost about 15 cents per 1,000 pounds, a slight increase over the cost of shoveling cinders, due to the greater difficulty of shoveling the lump coal as contrasted with the finer cinder. The probable maximum saving with mechanical equipment would be about 10 cents per 1,000 pounds, which applied to 400,000 pounds handled per year indicates a saving of $40.00 per year.

Equipment Required

In the small plant it then appears that the mechanical equipment will be used in the main for handling the aggregate, and for this purpose many types of standard equipment are available and are in successful operation in many products plants throughout the country. In all plants the elevating equipment will be required, and in the cinder products plants the screening equipment will be required in addition. The elevating equipment in most general use is of the bucket type, buckets carried either on chain or belt, which in the case of cinder aggregate, provides a continuous delivery of material to the screens.

Some plants of larger size are equipped with simple shop equipment, designed for the repairs and maintenance of their entire equipment, and this leads to the consideration again of the saving that can be accomplished in the smallest plant by a wide-awake mechanic, in the design and construction of simple types of equipment. For example, in the matter of chutes for handling cinders. This abrasive material is very hard on any equipment. Steel chutes are subject to both wear and corrosion; wood chutes wear out very soon. One plant increased the life of simple wooden chutes many times by lining them with some old belting that had been discarded.

Screw Feeder Arrangement

In one plant a screw type feeder had been installed to feed the elevating equipment and worked with reasonable success, although some difficulty was experienced due to rather wet cinders being received from time to time. Through some mishap, the drive to the screw conveyor was broken and in order to continue unloading the car, the screw was removed and the operator arranged an improvised gate to control the flow of cinders from the pit to the elevator. This worked so well that a permanent control gate was installed at the expense of a few dollars, which on the whole gave less trouble in operation than the screw drive costing some $50.00. The simplest device that will accomplish the desired result is the one to be adopted, particularly in the small plant.

In recent years, screening equipment has been added in cinder concrete products plants. With cinders delivered to the bins directly from the crusher, a certain amount of segregation occurred, the coarser material rolling to the outside of the bin while the finer material remained in the center or under the point of discharge of the chute from the crusher. The result was a variation in the grading of the aggregate as drawn from the storage bins and delivered to the mixer. One method of avoiding this is to install screening equipment and deliver two sizes of aggregate to two bins, which can then be recombined in definite proportions to produce a uniform product.

Common Screening Methods

The screening equipment in general use is for the most part of the rotary or the jolting types, vibratory screens being used in some cases more recently. Their use is recommended for the reason noted above, and moreover, the use of the screen permits the delivery of all material that will pass the screen directly to the bins, leaving for the crusher only the oversized material. In the average run of cinders, the crusher may have to handle only from 15 to 30 per cent of the total, which is a direct advantage from the power consumption standpoint.

More or less difficulty has been experienced in the screening of cinders, particularly when wet, in spite of which the procedure is to be recommended. The fact that the grading of the aggregate in the bins may vary with the wetness of the material is acknowledged, but this can be compensated for by varying the proportions used from the bins and the product can be kept reasonably uniform, far more so than when the bulk material coming from the crusher is used in the usual way in plants without screening equipment.

Well Graded Aggregates Require Less Cement

And this leads up to a further consideration of the grading of aggregates used in products manufacture. Concrete is an artificial or synthetic stone made by mixing with a coarse aggregate of broken stone or pebbles enough of a finer aggregate, such as sand, to fill the voids occurring between the pieces of the coarser aggregate, and then filling the remaining voids existing between the pieces of the fine aggregate with a cementing paste composed of cement and water. This cement paste, in the same process, is supposed to form a coating over the surfaces of all pieces of the entire aggregate.

As the cost of the cement used in the manufacture of concrete is far in excess of the cost of the aggregate, per unit of volume, it is a matter of economy to design the mixture in such a manner that the smallest amount of cement be used to give the desired quality. It is in this connection that the grading of the aggregate demands attention.

The amount of the void in different aggregates varies with the shape of the individual pieces. But since the cement mortar is used to fill the remaining voids in the aggregate and to coat the surfaces of all pieces of the aggregate, this will be a minimum when the coarse aggregate is present in all sizes up to the largest practicable size, since the surface area to be coated increases with the square of the size, while the volume occupied increases with the cube of the size. Next, the voids between the pieces of coarse aggregate should be filled with the largest pieces of a smaller sized aggregate that will fit in, and so on down to the finest sand used, all voids that can be filled with fine aggregate and sand, saving the amount of cement mortar that has to be provided.

All of this is well known and in the ordinary mixing of concrete for monolithic concrete construction, the matter of grading is given careful attention. The points above are recited to bring the matter to bear on the grading for the products business. Here the size of the coarse aggregate is limited to from ½ to ¾ in., but the above considerations indicate that the maximum amount of this sized material should be used. The large sized aggregate will range from ⅜ to ¾ in. and the small from ⅜ in. down, but it is essential for economy to use the greatest amount of the coarser aggregate that will work well in manufacture, and to use the smallest amount of fine that will serve to give the necessary quality to the product. These observations apply equally to stone and to cinder concrete.

In the former plants the aggregate is usually prepared as purchased and attention should be given to the specifications as to sizes of material ordered. In the cinder block plants the aggregate is prepared by screening and crushing and the matter can be governed to a large extent. And this is the reason for the plan suggested above, of passing the cinders as received, directly to the screens, in order to retain as much of the larger sized pieces as possible, or as may be necessary. If, then, the cinders as received have enough fine material, the crusher rolls should be separated in order to produce the minimum amount of fine. By adjusting the rolls the relative amounts of fine and coarse can be controlled to a considerable extent.

This control of the mix leads to uniformity in the product, and the proper design of the mix leads to economy in cost. In the case of one plant making cinder block, the practice called for the production of from 12 to 13 blocks per bag of cement, and for years this was the general figure for many plants using ungraded cinders. The first attempt at grading, using two screens, one ¾-in. and the other ⅜-in., the crusher handling only the oversized material from the screens, raised the production to from 16 to 17 blocks per bag of cement. If cement is figured at 50 cents per bag, this change results in a saving of nearly 1 cent per unit. Also, the product was more uniform in appearance and was of equal strength.

concrete blocks

This matter of grading has been carried to greater limits of refinement in some plants and the production of 22 blocks per bag of cement has been reached for cinder blocks which test above 1,000 lb. per sq. in. at the age of three weeks. Such production effects another decrease of 0.7 cents in cost of cement, a total reduction of nearly one-half the cement cost first mentioned.

In the manufacture of cinder concrete blocks, where a concrete with built-in voids is desired on account of the greater heat insulation and lower capillarity, the matter of grading is particularly important.

Various Policies Continue to Exist in Direct Cement Sales

The statement in a news item in last month's issue, in regard to users buying cement direct, has brought forth statements from manufacturers, dealers and others indicating that details of such a policy are still far from being uniform. Some companies are quoting direct to national and state governments and some include smaller governmental units. Contractors doing certain kinds of public or semi-public work are also included by some and not others.

While the dealer differential has been abolished, there is still enough diversity of practice in making direct quotations to make it impossible for would-be direct buyers to be governed by any universal rule. Contractors, central mixing plants, concrete products manufacturers, and others who may contemplate buying direct are urged to consult the cement company from whom they wish to purchase, or their local dealers.

"U-Stirrups in Concrete Beams Located With Chart"

The first equation on Page 42 of the May issue of CONCRETE, in the article under the above title, was printed erroneously. Corrected, it is

$$v = \frac{23{,}000}{0.88 \times 18 \times 12} = 121$$

Contractor Develops Large Business in Concrete Tennis Courts

Reputation for High Quality of Workmanship Overcomes Price Basis Competition—Special Field Requires Special Construction Experience—Coloring of Courts Recommended

By L. A. CLINE
Contractor and Engineer, Los Angeles, Calif.

L. A. Cline, a contractor and engineer of Los Angeles, California, has built a large business specializing in high-class concrete tennis courts and other concrete work. This includes swimming pools, retaining walls, occasional buildings, principally residences, and more than 200 reinforced concrete championship tennis courts. Due to the type of work performed, and due to the degree of supervision exercised over his work, Mr. Cline's prices may be slightly higher than those of the average contractor; but this increased price, if any, is evidently being paid willingly, judging from the volume of his business. Mr. Cline, through the years of experience in following this policy, has found an increasing tendency on the part of architects and owners to prefer quality construction, with its slightly higher initial cost but greater ultimate economy. His total work in the course of a year reaches a high figure and compares favorably with other leading contractors in his locality.—The Editors.

ABOUT ten years ago, in southern California, the reinforced concrete tennis court had its beginning. Earlier concrete courts had practically no reinforcing; but as time went on, the reinforced concrete slab proved the best type. As may be seen from the drawing, the slab is almost as heavy as that used for modern building construction, and it is reinforced with a large amount of steel. The reinforcing bars are placed in the slab to eliminate any tendency to crack or heave because of temperature and moisture changes. Much attention is also paid to the exactness of the construction, since only by doing this can accurate results be obtained and a truly perfect court laid.

Today approximately 85 per cent of all the tennis courts in southern California are constructed of reinforced concrete. This is also true of the resort country of Arizona.

Character of Surface Is of Great Importance

An item of great importance in a tennis court is to have a surface that provides uniform playing conditions under all changes of temperature and moisture. Clay or grass courts necessarily present variable surface conditions, due to differences in moisture and temperature. On a properly constructed and well drained reinforced concrete court, it is possible to play tennis within a very few minutes after a heavy rainfall. A well built court offers a uniform playing surface, free from depressions or ridges that cause uneven bouncing of balls.

By painting playing lines on the surface, one may eliminate the tapes, often a source of dissatisfaction to players. Also, painted lines are fairly permanent, it being necessary to renew them only once a year, quite unlike the lines on a clay-surfaced court, which must be renewed after every rain and often more frequently.

One of the most favorable features about a concrete tennis court is the fact that the surface may be colored to harmonize with the general color scheme of the surrounding landscape. Coloring may be accomplished in several ways. The concrete slab may be stained by a special chemical process, or mineral coloring pigment may be incorporated into the concrete in the upper layer of the slab. This latter method is perhaps the most satisfactory for coloring a concrete court.

Comparative Cost of Different Types

A properly constructed reinforced concrete court in southern California will cost approximately twice as much as one constructed of local clays. However, if it is necessary to import clay, the concrete court may be built for about 60 per cent of the cost of a clay court. Other types of material range in cost from 50 to 150 per cent of a reinforced concrete court. As mentioned previously, the initial investment in tennis courts should not be the primary consideration. The maintenance expenses are the items that determine the cost of playing tennis on a court for a period of years.

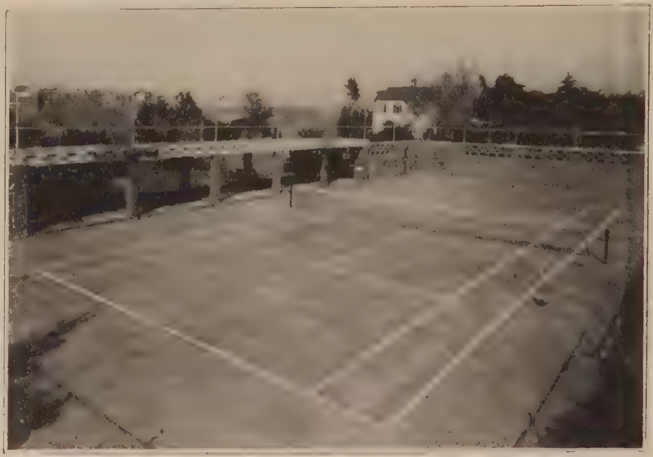
Expert Supervision of Construction

One of the necessary considerations in the building of a concrete tennis court is the supervision during the construction period by an expert on this type of work. Not every contractor is qualified to build a satisfactory court. The surface texture, made with a special steel trowel and a rotary finish which we have developed, produces a true finish and a playing surface free from unevenness. For the attainment of a uniform color, good workmanship and experience are vitally necessary. All this requires experience of a special kind—experience that can be acquired only through actual construction of tennis courts.

Hardness of Concrete Courts No Handicap

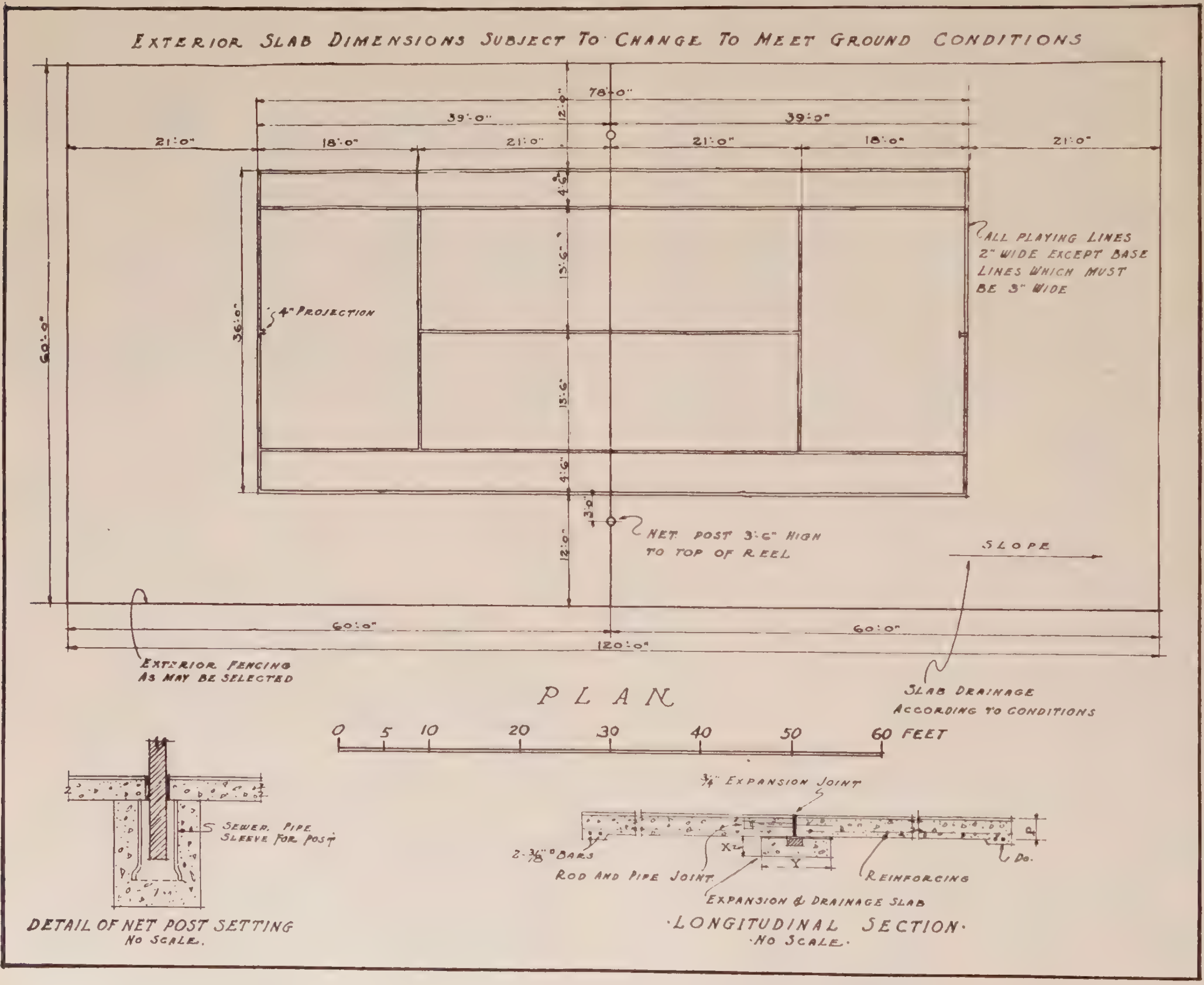
It has often been said that concrete courts are hard and unsatisfactory to play upon. This is a complaint which we in southern California know is unjustified. Wynn Mace, professional of the Los Angeles Tennis Club, after having played on the courts for a number of years, says there is positively no reason for saying that a concrete court is too hard. Tennis shoes today are built with heavily cushioned soles for the purpose of absorbing shocks or jolts.

A rather amusing incident came to the writer's attention in this connection. One player, after having played on the courts at La Cienega playground in Beverly Hills and at the Los Angeles Tennis Club, complained that the Los Angeles Tennis Club courts were hard but that La Cienega courts were ideal for playing. They seemed resilient and soft to the feet, besides making an excellent surface for playing a fast game. The facts are that both of these reinforced concrete courts are made according to identical specifications, La Cienega courts being colored a rich, leathery brown. Apparently the coloring made this player believe that they were much softer than the other courts.



This concrete tennis court in Santa Monica is a good example of this contractor's workmanship

The manner in which color influenced the mental attitude of this player suggests the advisability of using judicious amounts of mineral colors in all tennis court work.


EXTERIOR SLAB DIMENSIONS SUBJECT TO CHANGE TO MEET GROUND CONDITIONS
78'-0"
39'-0"
39'-0"
21'-0"
18'-0"
21'-0"
21'-0"
18'-0"
21'-0"
12'-0"
4'-6"
13'-6"
13'-6"
4'-6"
3'-0"
12'-0"
36'-0"
60'-0"
4" PROJECTION
ALL PLAYING LINES 2" WIDE EXCEPT BASE LINES WHICH MUST BE 3" WIDE
NET POST 3'-6" HIGH TO TOP OF REEL
SLOPE
60'-0"
60'-0"
120'-0"
EXTERIOR FENCING AS MAY BE SELECTED
SLAB DRAINAGE ACCORDING TO CONDITIONS
PLAN
0 5 10 20 30 40 50 60 FEET
SEWER PIPE SLEEVE FOR POST
DETAIL OF NET POST SETTING
NO SCALE.
3/4" EXPANSION JOINT
2-3/8" ⌀ BARS
X
Y
ROD AND PIPE JOINT
EXPANSION & DRAINAGE SLAB
REINFORCING
Do.
·LONGITUDINAL SECTION·
·NO SCALE·

Typical plan and cross-sections of reinforced concrete tennis court

Modern Highway Practice as Seen by Mississippi Valley Group

Report of Twenty-Third Annual Conference Discusses Trends and Practice in Construction, Maintenance, Roadway Slab and Bridge Design, and Concrete Materials

By T. H. CUTLER
Chief Engineer, Missouri State Highway Department

PAPERS and reports of exceptional value to highway engineers were brought to light during the twenty-third annual meeting of the Mississippi Valley Conference of State Highway Departments, the proceedings of which have just been issued in a bound mimeographed volume.

Subjects under discussion at the meeting were grouped under the following seven headings:

1. Administrative officers' group.
2. Construction engineers' group.
3. Maintenance, traffic and equipment engineers' group.
4. Bridge engineers' group.
5. Design engineers' group.
6. Materials and testing engineers' group.
7. Auditors and accountants' group.

The available space will not permit even a condensed version of the excellent reports submitted by the first and last of the above groups. The purpose of this article is, rather, to emphasize matters having direct application to the engineering duties of the highway engineer.

Construction of Concrete Pavements

Practices and trends in the construction of highways, covered in the report presented by the construction engineers' group, contains a number of points having application to concrete pavements.

Expansion Joints. Notable among the questions discussed, for instance, was that of expansion joints. Nearly all states feel the need of, and are building, contraction or expansion joints for the protection of the concrete slab. However, there is a wide variation in the practice, especially as to the spacing of the joints and their width.

Use of Wire Mesh. The states were equally divided as to the use of wire mesh in concrete pavements. Some that had used it cautioned against the use of steel sleds in placing, a practice which is likely to cause cracks in the pavement.

Half-Width Pavements. There was no general objection by those states that had placed one-half of the slab in order to stretch their road mileage. The public are generally satisfied with that type of road. However, it should not be used on a heavily traveled road.

Weighing Aggregates. While weighing of concrete aggregates has been adopted by all states for pavement, some are not weighing for small structures. Those states that are weighing the aggregate for small structures are well pleased with the system.

Use of Bulk Cement. Three states are using nothing but bulk cement, while the rest have used it more or less. Those states that are using bulk cement are very enthusiastic about the results, and recommend that plan.

Coarse Aggregates in Two Sizes. While only a few states have been experimenting with the separation of the coarse aggregate, there is a growing opinion that such a course will be necessary in order to secure uniformity in the concrete.

Filling Cracks and Raising Settled Slabs

In the discussion of the report of the maintenance, traffic and equipment engineers' group the subject of filling cracks in concrete pavements brought forth much debate. Probably there has been less thought and attention devoted to this feature of maintenance than to any other. Years ago some one observing cracks in concrete roads decided to fill them with asphalt or tar, and since then maintenance engineers have followed in the footsteps of this unknown predecessor. Great advances have been made in all other methods of highway design, construction and maintenance, but as to crack filling, we are using about the same methods that Adam used in filling the cracks between the cobble pavements in the Garden of Eden. One or two states even suggested that the effort was somewhat useless, and in these states certain sections of pavement are being set aside on which no work at all is being done, in order to compare these sections with those receiving attention. So far these states report that the results are as good where the cracks have been neglected as where they have been filled. The general consensus was that the present methods and materials were unsatisfactory, but that in view of the urgent need for employment relief, would continue the practice for the time being. One state reported contracting this work at a fixed amount per mile; other states take care of the work by gangs; while others have a sectionman assigned to 25 or 30 miles, who gives his section continuous attention along with other work. It was generally conceded that this phase of maintenance needed further study.

In Iowa a mud pump is being used to raise settled and warped concrete pavements.[1] About 50 per cent of the mud pumped under the pavement is utilized in filling voids in the subgrade, while the other 50 per cent is effective in actually raising the slab. This subject was covered in detail in a paper by W. H. Root, maintenance engineer, Iowa State Highway Department.

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[1] See article in January, 1931, issue of CONCRETE, page 27.

Highway Bridges

The report of the bridge engineers' group brought forth a number of ideas that resulted in general discussion.

Effect of Increased Vehicle Weights on Bridge Loading. This subject stimulated a considerable amount of discussion. A majority of the states are designing for the H-15 loading of the A.A.S.H.O., which, considering the capacity of our pavements, is ample. Existing pavements and bridges will carry this loading; but to avoid jeopardizing our investment, the present tendency to increase maximum legal loads must be stopped. In several states the law allows 16,000 lbs. axle loads, and these states do not favor any further increase. The consensus of the group meeting was that legal loads should not exceed the limitation set forth in the resolution adopted by the A.A.S.H.O. at the Pittsburgh meeting last fall.

Opposed to Low-Cost Bridges

It was agreed that so-called "low-cost bridges" had no place on main trunk highways except for temporary construction to allow for changing conditions, and where the final location or alignment is not yet determined. The proper field for such construction is on roads of secondary importance where funds are limited. Discussion indicated that one of the best types of low-cost bridges is the combination of reinforced concrete floor slab supported by concrete-encased steel beams.

Concrete Mix Control. The use of a concrete mix designed to produce the required strength was favored in the group report. We also recommend proportioning by weight with rigid field control of all materials.

Cold Weather Concreting. Placing concrete in cold weather is not considered desirable. Recognizing, however, that a certain amount of winter work must be done, the group report recommends the most rigid specification for heating materials and for protection of the concrete during the hardening period. For protection of finished work, housing and steam heating are favored in preference to salamanders.

Design Group Report

The design engineers' group report recommends widened intersections and traffic-controlled lights at all intersections or junctions of highways when the anticipated traffic exceeds 2,000 vehicles per day on each route.

The relative merits of transverse joints and wire mesh reinforcement for the control of cracking were discussed at considerable length.

Materials Group Report

The materials and testing engineers' group report includes some interesting items on the making of concrete.

Weight Proportioning. The consensus of the committee favored the use of weight proportions for structures to the extent possible with the present development of equipment. One state, Illinois, reported practically all structures being constructed with this method of proportioning, with satisfactory results.

Bulk Cement. A growing tendency is noted for the use of cement delivered in bulk. Savings in cost, and of sack loss and the possibilities of greater yield in batching, make this method popular. Several states now furnish practically all cement in bulk with no particular difficulties experienced.

Fractionated Aggregate. Several states will try the use of fractionated aggregate for the first time during the coming season. Gains in workability through elimination of segregation and greater economies of yield are anticipated.

Expansion Joint Material. No satisfactory material has as yet been developed for use as expansion joint filler. Poured material seems to be favored over premoulded mastics, with considerable sentiment apparent for the development of some form of practical air joint.

Design of Concrete Mixtures

A paper of outstanding value and importance was presented by V. L. Glover, engineer of materials, Illinois State Highway Department, under the title of "Design of Concrete Mixtures." Interesting features of the paper included an explanation of the proportioning of concrete by the mortar void method, and the technique of making the mortar void tests.

✦ *Personals* ✦

Lee S. Trainor, formerly in charge of the Chicago office of McEverlast, Incorporated, has been appointed chief engineer of the construction division of the National Lime Association, with offices at 927 Fifteenth Street, N. W., Washington, D. C.

The use of lime in concrete, stucco, mortar, plaster, and similar uses in construction work, fall within the scope of the activities of this division of the association.

Charles S. Barr, formerly chief structural designer for The Clarence W. King Architects, Shreveport, La., has entered the newly organized firm of Long & Barr, architects and engineers, with offices in the Bernhardt Building, Monroe, La.

George B. Bosco, for many years engaged in the concrete construction industry as superintendent of construction, has opened an office at 20 N. Wacker Drive, Chicago, specializing in the design of concrete form work. Mr. Bosco is the inventor of several concrete form specialties.

"A Single Breaker May Recede—
But the Tide Is Coming In!"

Are you cleared for action? Now is the time to tune up the old machine,—to have your organization ready for the bigger business and the larger profits which are surely on their way. For manpower apply to—The National Engineering Societies and ATAE.

When you are in need of industrial and technical executives, professional engineers, or technicians—communicate with:—Engineering Societies Employment Service: New York Office—Walter V. Brown, Manager, 31 West 39th Street; Chicago Office—A. Krauser, Manager, 205 West Wacker Drive; San Francisco Office—Newton D. Cook, Manager, Room 715, 57 Post Street.

This service is the contribution of these professional organizations to industry.

Short-Cuts in Structural Design

Reinforced Concrete Wall Footings Designed As Cantilevers—Shearing Stress Likely to Be High—Use of Charts Saves Time

III—Shear and Bending in Wall Footings

By JAMES R. GRIFFITH
Professor of Structural Engineering, Oregon State Agricultural College

REINFORCED concrete wall footings are designed as cantilever beams of unit width. Since their projection is small as compared to the depth, the shearing stress is apt to be high. Both shear and bending should be investigated.

While it is theoretically possible to reinforce a footing for high shearing stress, it is far from being practical. Footings are usually designed for sufficient depth so that shear reinforcement is not necessary. Many of the older building codes permit web stresses of 40 lb. per sq. in. without reinforcement. The more modern codes figure the allowable shear as a function of the ultimate strength. The accompanying shear chart has been prepared for both 40 and 60 lb. per sq. in. as the allowable shear without web reinforcement. These are probably the values most used.

Critical Section for Shear

The critical section for shear is usually taken at the intersection of the reinforcing and a 45-degree plane from the edge of the wall, Figure 1. The forces acting are the unit soil pressure (w_1) acting up, and the weight of the footing (w_2) acting down. The resulting load on the projected footing is ($w_1 - w_2$). The value of (w_2) is usually small as compared to (w_1) and can be neglected for first approximations. The left-hand scale on the shear chart gives the soil pressure, depending upon the allowable shearing stress. For final solution the value used on this scale should be $w = (w_1 - w_2)$.

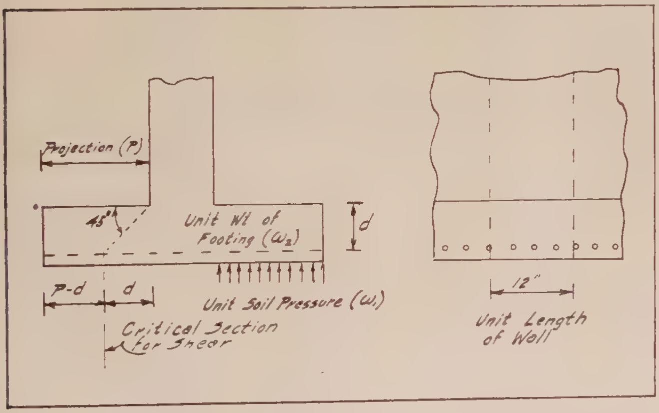

Projection (P)
45°
Unit Wt of Footing (w_2)
d
P-d
d
Unit Soil Pressure (w_1)
Critical Section for Shear
12"
Unit Length of Wall

Figure 1

The total shear at the critical section is—

$$V = (w)\ (P - \frac{d}{12})$$

(P) is the footing projection given in feet;

(d) is the effective depth of the footing, given in inches.

The unit shear is given by the expression—

$$v = \frac{V}{bjd}$$

But $b = 12$ inches, since a unit length of wall is considered, and (j) is taken as ⅞ for shear computations. So we then have the expression—

$$v = \frac{V}{12 \times 7/8 \times d}$$

Now substituting the expression derived for the total shear—

$$v = \frac{w\ (P - d/12)}{12 \times 7/8 \times d}$$

Equating this last expression to the allowable shear without web reinforcing and solving for the projection (P), we have—

When $v = 40$ lb. per sq. in.—

$$P = (\frac{420}{w} + 0.0833)\ d$$

When $v = 60$ lb. per sq. in.—

$$P = (\frac{630}{w} + 0.0833)\ d$$

The chart solves these two equations by a straight line through all scales.

Critical Section for Bending

The critical section for bending is usually taken at the edge of the wall. From Figure 1, we then have—

$$M = 12\ \frac{w P^2}{2}$$

(M) is bending moment in inch-pounds;

(w) is resultant load on projected footing; $w = w_1 - w_2$, in lb. per sq. ft.

(P) is the projection in feet.

For balanced reinforcing—

$$M = K\ b\ d^2$$
$$A_s = p\ b\ d$$

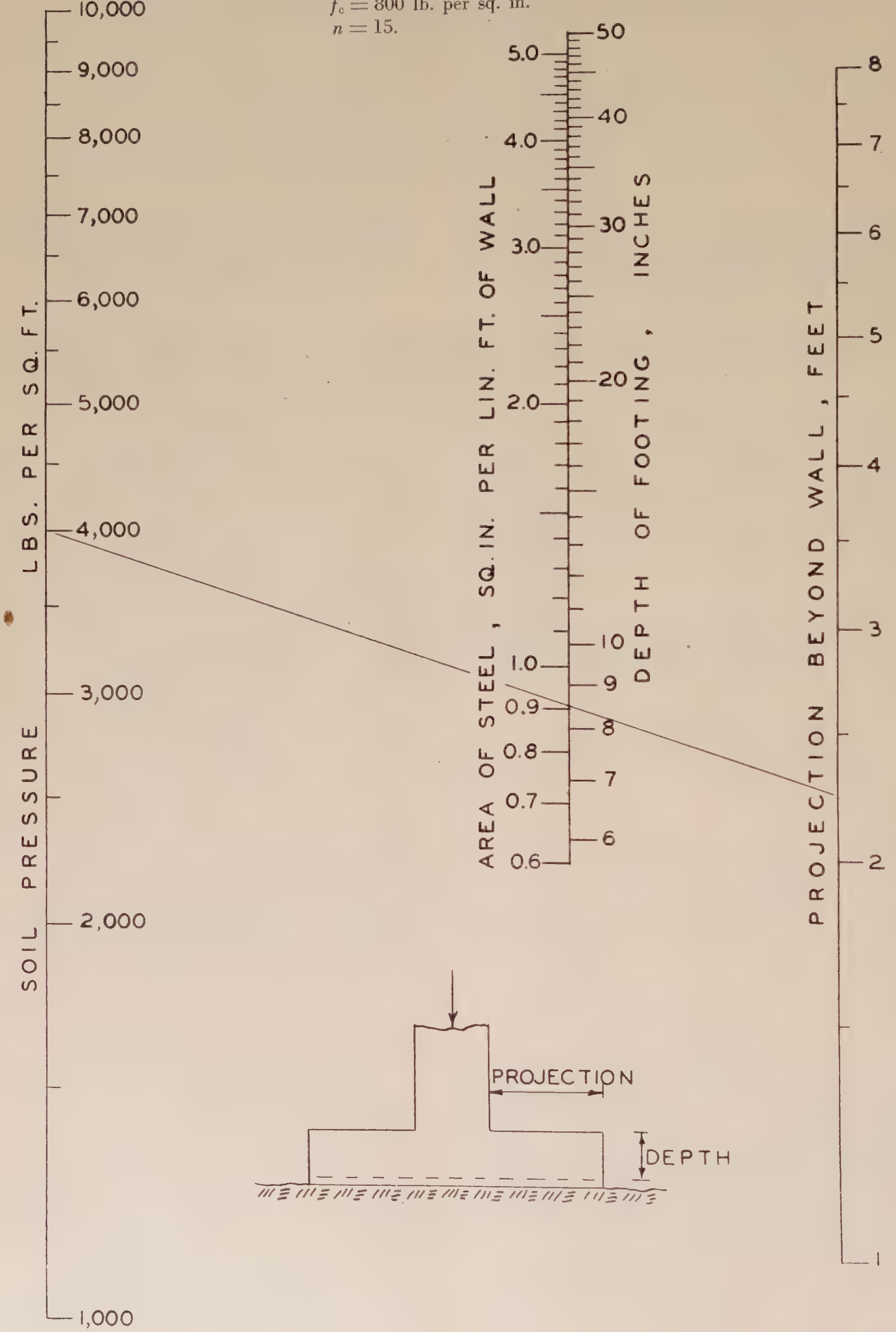
For values of $f_s = 18{,}000$ lb. per sq. in., $f_c = 800$ lb. per sq. in., and $n = 15$, the above formulas reduce to the form—

$$M = 138.7 \times 12 \times d^2 = 1{,}665\ d^2$$
$$A_s = 0.0089 \times 12 \times d = 0.1068\ d$$

since the value ($b = 12$ inches) is for a unit length of

Depth and Reinforcing for Wall Footings Controlled by Flexure

$f_s = 18{,}000$ lb. per sq. in.
$f_c = 800$ lb. per sq. in.
$n = 15.$



wall. The flexure chart solves these two equations with a straight line.

Illustrative Problem

Let me illustrate the use of the two charts by a problem.

A 16-inch wall supports a total load of 23,100 lbs. per lin. ft. and rests on a soil whose safe bearing power is 2 tons per sq. ft.

Required: To design a footing under the 1924 Joint Committee Specifications, using—

$f_s = 18,000$ lb. per sq. in.
$f'_c = 2,000$ lb. per sq. in.

The total footing width, neglecting wt. of footing, is—

$$\frac{23,100}{4,000} = 5.78 \text{ feet.}$$

$$\text{Total projection } (P) = \frac{5.78 - 1.33}{2} = 2.23 \text{ feet.}$$

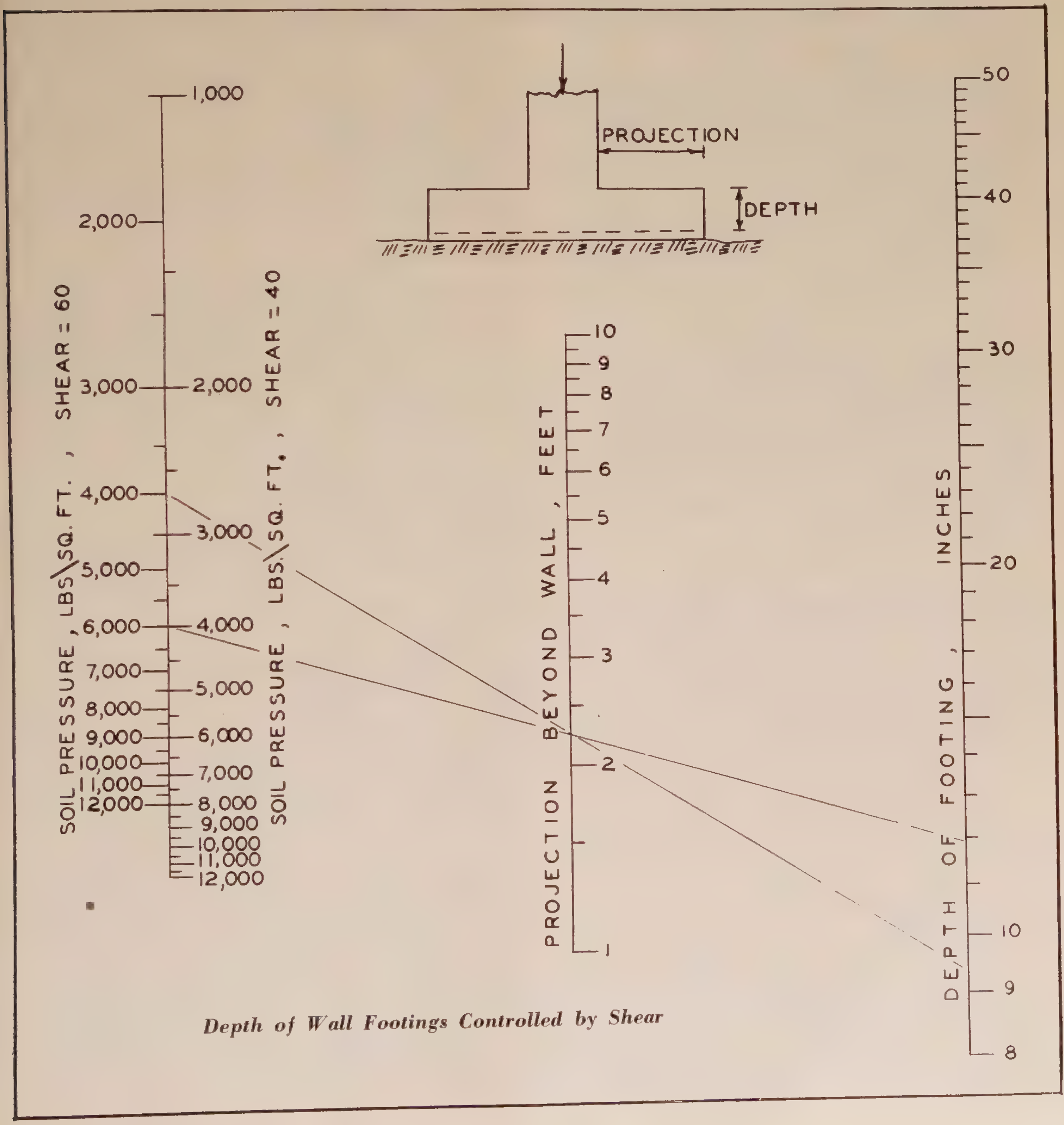
On the flexure chart the solution is shown with a straight line through the values—

$P = 2.23$ ft.
$w = 4,000$ lb. per sq. ft.

Obtaining the values—

$d = 8.5$ inches;
$A_s = 0.91$ sq. in. per lin. ft. of footing.

If we ignored the shearing stress, as many designers do, and used this depth, we would obtain—



Depth of Wall Footings Controlled by Shear

Total shear on critical section =

$$V = 4{,}000\,(2.23 - 0.71) = 6{,}080 \text{ lb.}$$

Unit shear—

$$v = \frac{6{,}080}{12 \times 7/8 \times 8.5} = 68.2 \text{ lb. per sq. in.}$$

The Joint Committee Specifications permit, for 2,000-lb. concrete, the following shearing stresses without web reinforcing:

60 lb. per sq. in., bars with special anchorage,

40 lb. per sq. in., bars without special anchorage.

So it will be seen that the shear would have been excessive.

The shear chart shows solutions for both allowable values of shear.

For shear = 40 lb. per sq. in., straight bars—

Depth required, $d = 11.9$ inches.

For shear = 60 lb. per sq. in., bars hooked for anchorage,—

Depth required, $d = 9.3$ inches.

It will be noted that I have made no assumption, so far, as to the weight of the footing. For final refinement it should be included. With the information already obtained, and using an allowable shear of 60 lb. per sq. in., I would assume an overall depth of 12 inches. The resultant soil pressure would then be—

$$w_1 - w_2 = 4{,}000 - 150 = 3{,}850 \text{ lb. per sq. ft.}$$

$$\text{Total required footing width} = \frac{23{,}100}{3{,}850} = 5.89 \text{ ft.}$$

Use 6.00 ft.

$$\text{Projection, } P = \frac{6 - 1.33}{2} = 2.34 \text{ ft.}$$

From the shear chart, depth $d = 9.5$ inches.

In order to obtain the reinforcing, I would go to the charts for unbalanced reinforcing published in the February (1931) issue of CONCRETE. Thus I would have—

$$M = \frac{3{,}850 \times 2.34^2 \times 12}{2} = 126{,}500 \text{ in.-lb.}$$

$$M/d^2 = \frac{126{,}500}{9.5^2} = 1{,}400$$

From the chart in the February (1931) issue—

$$A_s = 0.089 \times 9.5 = 0.846 \text{ sq. in. per ft.}$$

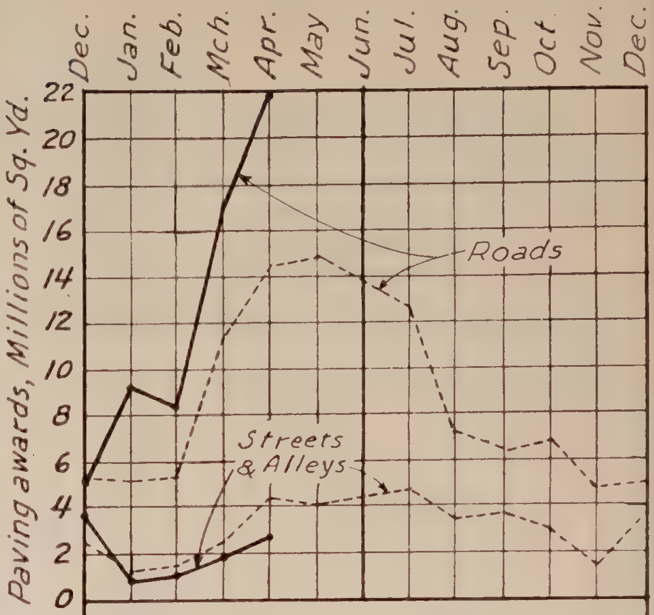
New Record in April Paving Awards

Four Months' Paving Contracts 39 Per Cent Ahead of 1930—General Construction Ahead in Three Sections

Another new record was made in monthly awards for concrete highway pavements when April produced a total of 21,982,248 sq. yd. represented in contracts let. This figure compares with 14,337,642 sq. yd. awarded in April, 1930, according to a compilation made by the Portland Cement Association.

Total concrete paving contracts as shown in the chart, now stand at 63,648,031 sq. yd. for the first four months of this year, about 39 per cent in excess of the 45,750,664 sq. yd. in the first four months of 1930.

Several bright spots in the April contracts for general building and engineering construction contracts are pointed out in the F. W. Dodge reports covering the 37 states east of the Rocky Mountains. In three of the thirteen Dodge territories contracts awarded in April exceeded the corresponding month's contracts in 1930. These three favorable territories are upstate New York, New Orleans, and the central northwest.



Dotted lines indicate 1930 contracts
Solid " " 1931 "

Total concrete paving contracts, in Sq. Yd., in first 4 months of year—

	1930	1931
Concrete Roads	36,233,037	57,094,413
Streets & Alleys	9,517,627	6,553,618
Totals	45,750,664	63,648,031

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Total contracts reported from the entire 37 states covered by the Dodge organization amounted to $336,925,200 in April, compared with $483,251,700 in April, 1930.

Cutting Corners in Concrete Structural Design

The August issue of "Concrete" will see the beginning of a new series of articles that will bring to structural designers a number of valuable labor-saving devices for use in the design of reinforced concrete buildings.

These generous contributions to the designing fraternity were prepared by a structural engineer who, for eight years, has served as chief engineer in the office of a leading Chicago architect.

Structural engineers and architects who do their own structural designing will find in these charts and tables the solutions for most of the problems arising in the general run of reinforced concrete building design.

A. S. T. M. Meeting to Deal With Cement, Concrete and Concrete Units

Specifications, Wall Stability and Fire Tests of Concrete Units Given Prominence—Papers on Cement and Concrete

During the thirty-fourth annual meeting of the American Society for Testing Materials, to be held at the Stevens Hotel, Chicago, from June 22 to 26, inclusive, producers and users of cement, concrete and concrete masonry building units will hold their heaviest sessions on Friday, June 26.

The tenth session, on the morning of Thursday, June 25, will be devoted to a symposium on the weathering characteristics of masonry materials. Among the various materials included in this part of the program, weathering of concrete will be discussed by E. Viens, and weathering of aggregates by L. O. Hanson.

The eleventh session, on the evening of Thursday, June 25, will consist of a joint meeting with the Western Society of Engineers. This session will include a paper by J. P. H. Perry, on the use of specifications from the standpoint of the producer of concrete, and one by Arthur R. Lord, on the use of specifications from the standpoint of the user of concrete.

Concrete Masonry Units in Limelight

A program of the utmost importance to the concrete products industry is scheduled for the thirteenth session, on the morning of Friday, June 26.

Specifications for Load-Bearing Concrete Masonry Units. The first of the papers on concrete masonry units will be the report of Committee C-10, by D. E. Parsons, chairman, on hollow masonry building units. The report will present specifications and tests for load-bearing concrete masonry units, under preparation during the past year by a sub-committee.

Tests on Stability of Concrete Masonry Walls. A report is to be presented by Prof. F. E. Richart, University of Illinois, detailing the results of a co-operative series of tests to determine the strength and stability of walls of concrete masonry units. The tests, made at the University of Illinois under a co-operative agreement between the university and the Concrete Masonry Association, included compression and stability tests of 51 large wall panels 6 ft. wide and 9 ft. 4 in. high, and 40 smaller panels, or wallettes, 2 ft. 8 in. wide and 4 ft. high, as well as tests of several hundred individual units. The report, which will be abstracted in a later issue of CONCRETE, discusses types of aggregate, types of mortar joints, wall thickness, types of units, strength of individual units, and composite walls.

Fire-Resistance and Stability of Walls of Concrete Masonry Units. A paper under this title, by C. A. Menzel, will describe the testing apparatus and methods, and results attained, in a lengthy series of fire tests of walls of concrete masonry units, made at the laboratory of the Portland Cement Association. Basic information will be presented covering the influence of the grading and type of aggregate, cement content, type of unit, type and amount of mortar, application of plaster, curing of unit, seasoning of wall, and related subjects.

Admixtures in Concrete

The afternoon session of Friday, June 26, will see the presentation of two papers on the effect of admixtures. One paper, by W. C. Bruce, will discuss the question whether standard cement specifications should permit the intergrinding of siliceous admixtures at the mill.

A second paper, by F. R. Wicks, will discuss the results attained in concrete by the use of crystalline talc admixtures.

Many Papers on Concrete

The final session (the sixteenth), on the evening of Friday, June 26, will see the presentation of seven reports and papers dealing with various phases of concrete.

The program of this final session will include a report of Committee C-9 on Concrete and Concrete Aggregates, by Cloyd M. Chapman, chairman; a paper on accelerated freezing and thawing as a quality test for concrete aggregates, by F. C. Lang and C. A. Hughes; a discussion of the relation of coarse aggregate content to the quality of paving concrete, by F. H. Jackson and W. F. Kellerman; a report from the society's representatives on the Joint Committee, by Cloyd M. Chapman, chairman; a paper on tests of concrete conveyed from a central mixing plant; a detailed description of the test program conducted at the University of California for three years, to determine the effect of curing temperatures on the strength of mass concrete, by R. E. Davis and G. E. Troxell; and a paper on the effect of time loading upon the bond stress between concrete and steel, by R. L. Brown.

George S. Bartlett Medal Established as Highway Award

Steps are being taken to establish a medal in honor of George S. Bartlett "to perpetuate the friendliness and helpfulness which he has brought into his work in the highway field." The medal will be awarded annually to an engineer, highway official, contractor or manufacturer who has made a notable contribution to the highway art or the highway industry.

"Every individual and every corporation in the highway and automobile industries has been helped by George Bartlett. He has created demand for more materials and equipment, more jobs for contractors, more positions for highway engineers and officials, more roads for automobiles to run on," the announcement of the George S. Bartlett Medal Committee states.

Mr. Bartlett has recently been appointed assistant to the chairman of the board of directors of the Portland Cement Association.

Coming Conventions

June 3-4—National Lime Association, thirteenth annual convention. White Sulphur Springs, West Virginia.

June 22-26 — American Society for Testing Materials, annual meeting. Stevens Hotel, Chicago, Illinois.

HOW TO DO IT

◆ **Questions and Answers** ◆
Consultation and Comment

A department devoted to the solution of problems encountered in concrete work. Readers are welcome to add to or improve upon the suggestions printed and to submit their views for possible publication.

Greater Density With Large Sizes of Coarse Aggregate

I have just read the explanation of the effect of large sizes of coarse aggregate, printed in the "How To Do It" page of the February issue of CONCRETE.

It seems to me that a clearer understanding will result if this subject is approached from a somewhat different angle.

Concrete mixtures fall into one of two classes —the over-mortared mixes and the designed mixes.

In over-mortared mixes there is more mortar than can be included in the void space in the coarse aggregate, with the result that in the concrete as placed the stones lay farther apart than they lay in the stone pile (or the gravel pile) from which they were taken. Prof. Talbot, of the University of Illinois, has shown that for mixes of this character the strength of the mortar determines the strength of the concrete. Practical experience fully confirms the soundness of his conclusions. As the very great majority of the mixes used today are oversanded mixes—that is, mixes in which the volume of mortar considerably exceeds the void content of the coarse aggregate used,—and since in all such cases the mortar establishes the strength of the mix, the proper reply to your inquirer would seem to be that, under ordinary circumstances, the size of the coarse aggregate will have no effect on the strength of the concrete.

On the other hand, if a designed mix is to be attempted,—that is, a mix in which some desired relationship, presumed to be of advantage, is maintained as between the various sizes of aggregate as well as a more or less fixed water-cement ratio and other refinements—all sorts of things can happen. Nevertheless, even here there is no very sound reason for thinking that size per se is a controlling factor. It is often so considered, because it is possible to use some combinations of materials effectively if large sized coarse aggregate is used that can not be used as effectively if smaller size coarse aggregate is employed. However, the real point here is that each designed mix is a problem by itself. There are absolutely no general rules which may be safely and certainly applied.—H. J. L., Clarendon, Va.

This question of using larger coarse aggregate than is usually sanctioned is a live question at this time. It must be understood, of course, that when we speak of large size coarse aggregate we are referring to aggregate in which all sizes of the coarse material are present, from the pea size up to the largest.

The effect of large sizes of coarse aggregate (again assuming that all sizes of the material from the pea size upward are present) is discussed by a number of state highway engineers on pages 14 and 15 of the May issue of CONCRETE, in the article entitled "Controlling Quality of Concrete for State Highway Work." It is significant that the opinions there expressed boil down to the statement that the use of two sizes of coarse aggregate results in better grading from the smallest to the largest; and that, in its turn, produces greater density in the concrete itself.

In a word, when these state highway engineers are speaking of the "better" concrete obtained from using two sizes of coarse aggregate they are probably not thinking of greater strength. They are thinking, primarily, of greater density and therefore greater durability. Their use of two sizes of coarse aggregate is simply their way of insuring the presence of all sizes from 3/8 of an inch up to 2½ or 3 inches.

Obtaining a Surface Finish

I am told that some preparation is available that may be painted on concrete forms so as to produce a surface finish without form marks. We are building a number of concrete dwelling houses here for the U. S. Government, and we would like to know where such a preparation may be obtained.—D. N. W., San Juan, Porto Rico.

Such a product is available in the form of a quick drying liquid, which is painted on the contact surface of the forms shortly before the concreting is started. The liquid prevents the setting of cement to a predetermined depth, depending on the strength of the liquid used. After the interior of the concrete mass has hardened in a normal manner this sand-like mortar at the surface is easily removed with a wire brush, leaving the aggregates exposed. The liquid has no continuing effect, and it does not affect hardened concrete.

This product, if not available locally, can doubtless be ordered through a local dealer in building materials.

If the purpose of exposing the coarse aggregate is that of forming a good key for stucco, material with a rough surface, such as crushed stone, slag, cinders, or manufactured aggregate of rough texture, should be employed as the coarse aggregate.

If the purpose is primarily to improve the appearance, as in your case, coarse aggregate of quartz or silica gravel, or any highly colored stone, will produce an excellent appearance and a good contrast with the gray, hardened mortar.

Furthermore, the maximum size of the coarse aggregate influences the surface texture. That is, if the coarse material is held to a maximum size of ½ inch the appearance of the surface will differ materially from the appearance when similar aggregate in sizes up to 1½ inches is employed.

The Concrete Industry

—25 YEARS AGO

THE structural devastation caused by the San Francisco earthquake was a timely subject following the disaster of April, 1906. The damage wrought is described in articles appearing in the then current issues of both CONCRETE and *Cement Age*.

J. Mayne Baltimore, writing in the June, 1906, issue of CONCRETE, observed that two very important things were shown: "First, that there is no such thing as an absolutely fireproof or earthquakeproof material. It is all relative and comparative; all depends upon the length and degree of the heat, and of the violence and duration of the shock." Also that "In every particular, good reinforced concrete stood well the most severe tests of shock, heat, and water."

Positive assurances have been given, he said, that there would be no advance in prices of any California-produced cement and that freight rate reductions had been effected to aid in rehabilitation.

* * *

TO the end of encouraging concrete block manufacturers to better their product, V. O. Wallingford, New Mexico architect, in an article tells readers some objections to the units that have come up in his experiments.

He sums them up as follows: The cement is not properly used to obtain its greatest efficiency; the production of cement blocks is largely attempted by inexperienced men, and with the sole idea of being done as cheaply as possible; and, the general uniformity in the size of the blocks precludes the most artistic results.

* * *

MEAT packing twenty-five years ago had not attained the present-day state of sanitary perfection, and reforms were in the offing. Early in the public agitation for improved conditions, CONCRETE saw the opportunity for concrete contractors to introduce the advantages of concrete, particularly of paving, and urged that they promote concrete among Chicago's Packingtown officials.

* * *

HOW an architect was successful in letting down building department barriers to concrete block and how he employed concrete in every possible use in a Staten Island residence is told in an article in the June, 1906, issue of *Cement Age*.

Severe tests at the Watertown arsenal were necessary to open the way for the use of block.

"The faces of the partitions, walls and ceilings," the article continues, "were covered with pulp plaster which was tinted or adapted to various applied decorations as occasion demanded. The floors, supported by 3 by 10 reinforced concrete beams, are laid in slabs in which strips of wood are embedded for the finished floor. The reinforced concrete girders extend below the ceilings of the first floor and support the partitions of the floor above.

"The roof, thoroughly fireproof, is made of reinforced concrete slabs supported by reinforced rafters, and extends down to form a cornice. The gutters are of wire mesh bent to the proper shape and covered with concrete."

Organizations

AMERICAN CONCRETE INSTITUTE; Harvey Whipple, Secretary, 624 Fisher Building, Detroit, Mich.

AMERICAN CONCRETE PIPE ASSOCIATION; M. W. Loving, Secretary, 33 West Grand Ave., Chicago.

AMERICAN ROAD BUILDERS' ASSOCIATION; Chas. Upham, Engineer-Director, 914 National Press Building, Washington, D. C.
Annual meetings, May 15-16, National Press Building, Washington, D. C.

AMERICAN SOCIETY OF CIVIL ENGINEERS; Geo. T. Seabury, Secretary, 33 West Thirty-ninth St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS; C. L. Warwick, Secretary-Treasurer, 1315 Spruce St., Philadelphia, Pa.
Annual meeting, June 22-26, Stevens Hotel, Chicago.

AMERICAN STANDARDS ASSOCIATION; P. G. Agnew, Secretary, 29 West 39th St., New York City.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA; E. J. Harding, Managing Director, 222 Munsey Bldg., Washington, D. C.

BUILDING OFFICIALS CONFERENCE OF AMERICA; Col. John W. Oehmann, Secretary, 1253 Lawrence St., N. E., Washington, D. C.

CANADIAN ENGINEERING STANDARDS ASSOCIATION; 178 Queen St., Ottawa, Ontario.

CAST STONE INSTITUTE; L. A. Falco, Secretary, Chapel St. and Blatchley Ave., New Haven, Conn.

CEMENT INSTITUTE; Luther G. McConnell, General Manager, 11 East 44th St., New York City.

CONCRETE MASONRY ASSOCIATION; Jack Franklin, Secretary, 7071 Plankinton Bldg., Milwaukee, Wis.

CONCRETE REINFORCING STEEL INSTITUTE; M. A. Beeman, Secretary, Tribune Tower, Chicago.

ENGINEERING INSTITUTE OF CANADA; 2050 Mansfield St., Montreal, Quebec.

JOINT COMMITTEE ON STANDARD SPECIFICATIONS FOR CONCRETE AND REINFORCED CONCRETE; F. R. McMillan, Secretary, 33 West Grand Ave., Chicago.

NATIONAL BOARD OF FIRE UNDERWRITERS; W. E. Mallalieu, General Manager, 85 John St., New York City.

NATIONAL CONCRETE BURIAL VAULT ASSOCIATION; J. H. Stuart, Secretary-Treasurer, Bremen, Ohio.

NATIONAL CRUSHED STONE ASSOCIATION; J. R. Boyd, Secretary, 751 Earle Bldg., Washington, D. C.

NATIONAL ENGINEERING INSPECTION ASSOCIATION; B. H. Witherspoon, Secretary, P. O. Box 1115, Pittsburgh, Pa.

NATIONAL FIRE PROTECTION ASSOCIATION; Franklin H. Wentworth, Secretary, 40 Central St., Boston, Mass.

NATIONAL LIME ASSOCIATION; Norman G. Hough, Secretary and Manager, 927 Fifteenth St., N. W., Washington, D. C.
Thirteenth annual convention, June 3-4, White Sulphur Springs, W. Va.

NATIONAL READY-MIXED CONCRETE ASSOCIATION; V. P. Ahearn, Secretary, 432 Munsey Building, Washington, D. C.

NATIONAL SAND AND GRAVEL ASSOCIATION; V. P. Ahearn, Executive Secretary, 432 Munsey Bldg., Washington, D. C.

NATIONAL SLAG ASSOCIATION; H. J. Love, Secretary-Treasurer, 937 Leader Bldg., Cleveland, Ohio.

NATIONAL TERRAZZO AND MOSAIC ASSOCIATION; U. F. Durner, Secretary, 809 St. Paul Ave., Milwaukee, Wis.

NORTHWEST CONCRETE PRODUCTS ASSOCIATION; W. P. Hews, Secretary-Treasurer, Yakima, Wash.

PORTLAND CEMENT ASSOCIATION; William M. Kinney, General Manager, 33 West Grand Ave., Chicago.

RAIL STEEL BAR ASSOCIATION; H. P. Bigler, Engineering Secretary, Builders' Bldg., 228 N. La Salle St., Chicago, Ill.

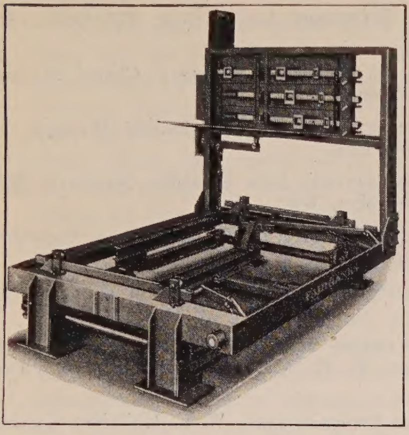
WISCONSIN CONCRETE PRODUCTS ASSOCIATION; Jack Franklin, Secretary-Treasurer, 425 East Water St., Milwaukee, Wis.

New Equipment and Materials

Accurate Aggregate Control Purpose of New Skip Mixer Scale

To facilitate accurate proportioning of concrete aggregates as demanded by law in most states for state construction work and as generally specified by structural engineers, Fairbanks, Morse and Co., Chicago, has recently made available to contractors a new Fairbanks skip mixer scale designed to eliminate guess-work in concrete construction.

The Fairbanks skip mixer scale consists of an all-steel welded frame and beam box in which is mounted a specially designed Fairbanks knife-edge lever scale with swiveled arm connections. Suspended from the scale levers is a welded steel spider onto which the skip is lowered for weighing. The scale is equipped with three ingredient beams made of non-corrosive metal graduated 1500 lbs. by 2 lbs., each of which is furnished with both a main and a fractional poise.



The main section of each beam is graduated 1500 lbs. by 100 lbs. and the fractional part 100 lbs. by 2 lbs. There is also a tare for balancing the weight of the skip. These beams are enclosed in a steel beam box with doors on both sides, either one or both of which may be opened for operation and secured with a padlock when not in use, or the poises may be set by an inspector and the beam box locked during operation.

A new style springless double-faced telltale showing "over and under" is mounted on a swivel so that it can be swung to any angle to insure easy reading irrespective of the position of the operator.

An automatic safety gear is provided which drops the platform free from pivots and connections with the beams allowing the platform to rest directly on the ground or foundation plates.

When the scale is set up for operation, the transport wheels with which it is provided are removed and the scale allowed to rest on the ground on four large steel plate pedestals. The scale is placed adjacent to the mixer in such a position that when the skip is lowered it rests on the steel platform. Steel angle guides are provided to insure the skip resting squarely on the platform.

With the skip resting on the platform, the operator presses a foot lever which brings the scale parts into their proper places ready for weighing. The first ingredient beam is then released by pulling a trigger on the outside of the beam box.

When the skip is in place, pressing the foot lever slacks the cables and with a disengaging joint between the skip and the mixer the two are separated so that the scale bears the full weight of the skip. Then the poise on the tare beam is moved until the indicator shows balance, after which poises on the three other beams are set in their predetermined places for the particular ingredients.

Materials are then dumped into the skip from wheelbarrows. No trimming of the wheelbarrow load is required and only the last load of any particular ingredient requires care in dumping, it is stated. The over and under indicator gives plenty of evidence when the beam is approaching balance so that the last load can be dumped in slowly and stopped at the proper point. The operation is the same for the other ingredients, each beam being released in turn by pulling a trigger on the outside of the beam box. The ingredients are then ready to be hoisted into the skip and discharged into the mixer.

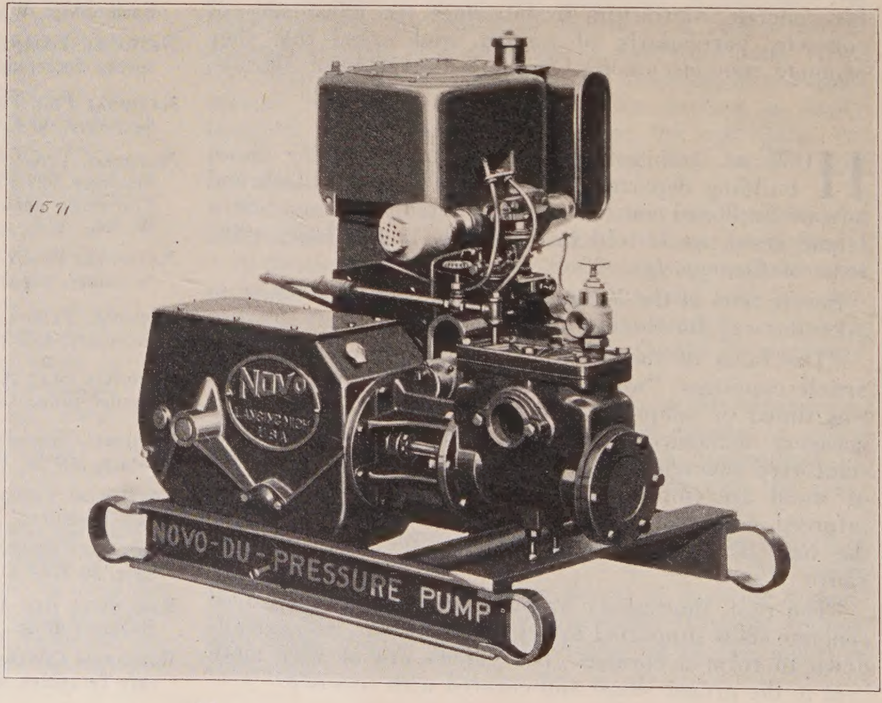
As the skip is raised and leaves the platform, it trips the automatic safety gear, which drops the platform to rest on the steel ground plates. Hence when the empty skip is returned, care in lowering into position is not necessary for the pivots and bearings and all parts of the mechanism have been freed by the automatic device.

Type DU Is New Novo Pump for Concreting Work

Designed for use with oils and gasoline in the operation of concrete mixers, steam shovels, drilling rigs, and jetting piles, the Type DU single-cylinder, double-acting unit has just been brought out by the Novo Engine Company, Lansing, Michigan.

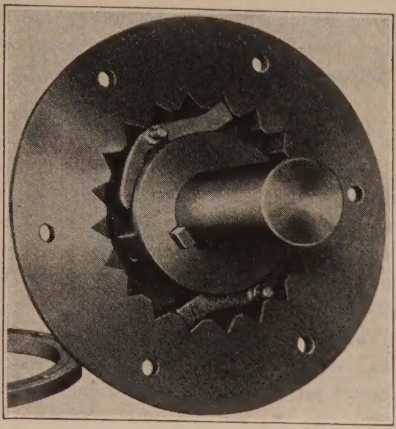
Its features include constant flooding with oil, compact design and light weight, complete enclosure, vibrationless anti-friction power, and governed design.

It is powered with the Novo Rollr engine, one and two cylinder, hopper cooled with circulating water from pump or furnished electric-motor driven or equipped with belt drive. The standard outfits are furnished skid-mounted with steel loops in the ends of skids for easy moving.



Life-Time Back Stop to Prevent Shaft Reversal

The Landahl Life-Time back stop recently placed on the market by the Fairfield Engineering Company, Marion, Ohio, is designed to provide a positive means of preventing shaft reversal. Its action is applied in such manner that no impact needs to be overcome and it operates automatically, silently and instantaneously, it is claimed.



It serves also as a bearing, and eliminates shaft and thrust in their direction so that no separate set collars are required. No extra shaft space is required as it takes the place of a standard type bearing.

Landahl back stops are built in two styles as illustrated in Bulletin No. 35-2.

Device Holds Road Slab Reinforcement

The Thornton Heights Construction Company, South Portland, Maine, is manufacturing a small device for holding concrete road slab reinforcement in place. The device consists of a flat piece of steel, punched to accommodate the reinforcing bars and with one end imbedded in a small block of concrete. J. A. Demarino is manager of the company.

Aluminum Straight-Edge Gives New Light-Weight and Design

Constructed of aluminum, a new straight-edge just placed on the market by the Cleveland Formgrader Company, Cleveland, Ohio, weighs 4 pounds, and is so constructed as to give greatest bearing area.

It comprises a box section with flat bottom, and the double-thick web and hemmed top for strength and stiffness. The 10-ft. blade complies with the majority of highway department specifications.

The aluminum handle is of seamless tubing, making it lighter and stiffer than wood, it is said.

About Makers of Equipment and Materials

New Book on Concrete Handling by Barber-Greene

The successful use of belt conveyors on a variety of concrete construction jobs from the world's largest building to a two-story church is described and illustrated in *"Concrete Handling,"* a new book printed and made available through the *Barber-Greene Company*, of Aurora, Illinois.

The handling of concrete and other building materials over belts on such nationally known construction jobs as the Detroit-Windsor tunnel, the Marshall Field Merchandise Mart, the Mississippi River lock between St. Paul and Minneapolis, and the Travel and Transport Building of the Chicago World's Fair, is described. The construction work shown covers the building of dams, locks, walks, sewers, tunnels, bridges, pavements, stadiums, viaducts, buildings, foundations, retaining walls, irrigation ditches, railroad elevations, and sewage disposal plants.

One interesting job described is the building of an underpass under the Southern Pacific Railroad main lines at Houston, Texas. Here limited working space required concrete to be carried across the railroad tracks without interfering with the passage of fast freight and passenger trains. The concrete was elevated on a conveyor to a height to give sufficient clearance to trains and was chuted across the tracks to the forms.

Another job shown is the construction of the American Can Company's new building in Chicago, on which seven conveyors saved $108 per day, finishing the five-story building five months ahead of schedule.

Besides the descriptions on jobs, the book contains engineering specification data on the Barber-Greene light type, and the Barber-Greene heavy duty concrete conveyors.

Concrete Handling is attractively bound and in addition to the copy matter, contains more than a hundred illustrations of various conveyor applications and features. Copies of this book may be secured by application to the Barber-Greene Company, Aurora, Illinois.

Fairfield Belt Conveyors Described

The Fairfield Engineering Company, Marion, Ohio, has recently issued a bulletin, *No.* 40-1, which gives complete and detailed information concerning *Fairfield portable belt conveyors* and their application.

Fairfield portable belt conveyors in sizes from 20 to 60 feet are being used extensively for the efficient handling of a wide variety of materials including sand, gravel, crushed stone, mixed concrete, and cinders.

They are furnished with belt widths of 20 and 24 inches and can be equipped with electric or gasoline power units as preferred.

A new bulletin describes the application of belt conveyors, their proper usage as well as giving pertinent information that is of interest to every user of conveyors, the company states.

Davey Compressor Publication

Users of compressed air in the field will be interested in the facts presented in "4 Air Compressors Went to School," as a 16-page, 8½ by 11 in. bulletin just issued by the *Davey Compressor Company*, Inc., Kent, Ohio, is entitled.

Tests and comparisons of features of practical value on the job, made by the professor and the associate professor of mechanical engineering at the Case School of Applied Science, merit investigation. How and why the Davey air cooled compressor won honors in a 500-hour non-stop test as well as in easy starting, cool operation, portability, etc., is discussed in this well illustrated and graphic bulletin.

Copies of the bulletin, as well as detailed technical data and service facts are available upon request.

Dunbrik Manufacturers' Guide

The Dunbrik Manufacturing Digest is being issued by the *W. E. Dunn Manufacturing Company*, Holland, Michigan, as a guide for Dunbrik manufacturers.

Of particular interest are the color plates showing the actual shades of tinted and the mat-glazed Dunbrik, and the Dunstone unit as combined with Dunbrik, illustrated in four of the more than 100 combinations possible. Dunstone dimensions are 8 by 7¾ in., and 8 by 11¾ in.

The Digest also includes cost and production records from a Dunbrik plant, test results, description of a Michigan plant, and typical merchandising matter.

New Facts on Curing

Such subjects as the report of the curing committee of the Highway Research Board of the National Research Council and the memorandum of the United States Bureau of Public Roards are covered in sections of "*Modern Methods of Curing Concrete Roads.*"

This is the 1931 issue of a publication distributed annually by the *Solvay Sales Company*, New York City, and is made up entirely of new material and information on the curing of roads with *calcium chloride.*

Wire Rope Uses

"*The Yellow Strand*" for May contains three or four interesting articles having to do with the use of wire rope in construction. The first of these concerns the dumping of 1,000,000 yards of earth for a Mississippi levee.

The publication is the house organ of the *Broderick & Bascom Rope Company*, St. Louis, Mo.

Cutting Costs

"Cutting Construction Costs" is the title of a comprehensive thirty-five page report prepared by the special risk and engineering department of the *Hartford Accident and Indemnity Company*, Hartford, Conn. While this report is intended primarily for clients of the company, copies are available to business executives who are directly interested in construction and contracting activities.

Lawrence Dragon

The leading article in *The Lawrence Dragon* for May is entitled "*Baltimore Building Great Airport*" and describes the construction of the adjoining concrete bulkhead for protection against sea water. A second article is devoted to the construction features of the New Jersey $20,000,000 viaduct.

The *Dragon* is published monthly by the Lawrence Portland Cement Company, New York City.

Link-Belt News

Interspersed in the *Link-Belt News* for May with brief articles on a variety of subjects are graphic descriptions of several equipment units. These include a conveyor chain that curves sideways, the new metal known as Promal, the K-55 Diesel engine operated shovel, truck and storage unit, and conveyor flights.

Billet Steel Specification

The Concrete Reinforcing Steel Institute, Chicago, Illinois, has had the new A. S. T. M. specification A 15-30 covering billet steel concrete reinforcing bars reprinted for insertion in the institute handbook and is distributing it in that form.

Hereafter all copies of the handbook mailed will contain the extra sheet as an insertion. It is not, however, being sent to all engineers who have previously received the handbook, but extra copies are available to members upon request.

Another recent publication is a 4-page leaflet on "Code of Standard Practice" on concrete joist construction and floor forms.

Bin and Hopper Bulletin

Bulletin 170-A, issued by the *Butler Bin Company*, Waukesha, Wis., is devoted to Butler bins and hoppers for concrete products plants. Photographs of eight actual installations and four elevation diagrams are shown. Weighing and measuring hoppers are covered in closing pages.

Novo Engine Bulletin

The one, two, and four cylinder *Novo Rollr* engines are described in *Bulletin* 146, a 38-page publication issued by the *Novo Engine Company*, Lansing, Michigan.

Each is fully described, including specifications, and illustrated. Installation data and photographs are also given.

Sterling Instruments

The Warren-Knight Company, Philadelphia, Pa., has issued a 64-page catalog of its engineering and surveying instruments, which are known as the *Sterling brand.* Included are transits, levels, tripods, extras and accessories.

Silicate of Soda Chart

A chart showing the use of silicate of soda in connection with concrete and prepared for the highway engineer's file has been issued by the *Philadelphia Quartz Company*, Philadelphia.

Form Devices

A group of individual circulars on four of its products has been brought out recently by the *M. & M. Wire Clamp Company*, Minneapolis, Minn. These are in addition to the complete catalog which the firm publishes.

The devices covered are shores, wire ties, screed gauges, and timber shores. Several job photographs show each in use.

Mineral Wool Publication

AllTite mineral wool is described in an 8-page publication published by the *Coast Insulating Company*, Los Angeles, Calif. Construction details are shown and a table gives standard styles and sizes. Thermal insulation tests and applications are given.

NOTES FROM THE FIELD

C. H. Adamson Heads Chicago Office

The Stephens-Adamson Mfg. Co., conveyor and screen manufacturers of Aurora, Illinois, have enlarged their Chicago office and moved to new quarters at 20 North Wacker Drive. *C. H. Adamson*, secretary of the firm, will be in direct charge of sales and engineering for the Chicago territory.

A confidence in the growing importance of Chicago as a manufacturing center is given as the reason for the increased sales and engineering staff.

Mr. Adamson has been director of all Stephens-Adamson advertising and sales promotional work for many years.

Lee Vice-President of Company

R. F. Lee is now vice-president in charge of sales of the *Lee Transit Mixer Company*, Indianapolis, Indiana. He is the engineer and designer of the Lee transit mixer.

J. B. Shephard, formerly president of the company, is no longer connected with the corporation, having been succeeded by *W. H. Trimble.*

Blaw-Knox Acquires Ateco Rights

The Blaw-Knox Company, Pittsburgh, Pa., has acquired the exclusive sales and manufacturing rights of the *Ateco* line of earth moving machinery from the *American Tractor and Equipment Company* of Oakland, California, for the United States east of the Rocky Mountains and for all other countries. The line includes hydraulically operated earth movers, bulldozers, scarifiers, tamping rollers and combination outfits.

Detroit Link-Belt Manager

Link-Belt Company, Chicago, Illinois, announce the appointment of *William L. Hartley* as district sales manager in charge of the Detroit territory.

Mr. Hartley has been in the employ of the Link-Belt Company since 1915, having started in the engineering department, working in the contract, standard and estimating departments.

Since 1928, he has been in charge of the foundry sales division of the company.

Foreign Fields for Road-Building Equipment

The export of highway materials and machinery to foreign countries where road programs are just beginning on a large scale will be a valuable addition to business, according to the American Road Builders' Association, which maintains Pan-American and European divisions to acquaint foreign engineers with American methods.